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THE PHILIPPINE JOURNAL OF SCIENCE

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MANUFACTURE OF CERTAIN DRUGS FOR THE TREATMENT OF LEPROSY [1]

By GRANVILLE A. PERKINS

Chemist, Bureau of Science, Manila

ONE PLATE

The chemical investigation of leprosy drugs by the Bureau of Science [2] has been continued since Brill's latest paper, especially since May, 1920, when the work was placed in the hands of the Committee on Leprosy Investigation, a joint committee of the Philippine Health Service, the University of the Philippines, and the Bureau of Science. Since that time the Bureau of Science has prepared a number of drugs, which were used experimentally at San Lazaro Hospital and Culion Leper Colony. Practically all of these have been found to be beneficial, in varying degrees. The report of this work from the medical point of view, including the methods of administration and observed effects, will be published by the committee. The present paper is written from the chemist's standpoint, and takes up the preparation and chemical composition of the drugs used.

The treatment of leprosy in recent years has tended away from the old methods of oral administration and inunction toward the injection method, both intramuscular and intravenous. Although the manner of application has changed, the

[1] Received for publication January 28, 1922.

[2] Brill, H. C., Hydnocarpus venenata Gaertner; false chaulmoogra, Philip. Journ. Sci. § A 11 (1916) 75; A chemical investigation of the seeds of Pangium edule and of Hydnocarpus alcalae, ibid. § A 12 (1917) 37; Brill, H. C., and Williams, R. R., The use of chaulmoogra oil as a specific for leprosy, ibid. § A 12 (1917) 207.

basis of the drugs most used has remained the same for centuries, chaulmoogra oil. Rock [3] has found an old Buddhist account of "a Burmese king voluntarily exiled for leprosy about 1,000 years ago who cured himself with the [chaulmoogra] oil, and likewise effected the cure of a beautiful young woman whom he afterwards married, founding a dynasty."

CHAULMOOGRA OIL

This oil, according to the present official definition, is the fixed oil from the seeds of *Taraktogenos kurzii*, a large tree which grows in the Assam Valley and Chittagong Hill Tracts, India. Similar oils, not correctly called chaulmoogra but perhaps quite as effective, are obtained from *Hydnocarpus wightiana*,[4] growing on the Malabar coast; *H. venenata*,[2 4] Ceylon, Deccan, and Burma; *H. castanea*,[4] Burma; *H. anthelmintica*,[4] Siam and French Indo-China; *Asteriostigma macrocarpa*,[4] Travancore; *H. alcalae*,[2] Albay, P. I.; *H. hutchinsonii*,[5] Mindanao, P. I.; *H. subfalcata*,[5] Zambales, P. I.; and *Onchoba echinata*,[6] Sierra Leone. *Pangium edule*,[2] found in the southern Philippines and neighboring islands, gives an oil somewhat similar in composition, but the oil from *Gynocardia odorata*, which was long confused with chaulmoogra, is totally different, from both the chemical [7] and the bacteriological [8] standpoints.

Chaulmoogra oil, like most fixed vegetable oils, is composed nearly entirely of fatty acids combined with glycerine. The principal fatty acids in the oil from *Taraktogenos kurzii*, and a few closely related species, most of which are mentioned above, are of a peculiar type known as the chaulmoogric acid series.

[3] Rock, J. F., U. S. Dept. Agr. Weekly News Letter 9 (1921) 1.

[4] Muir, E., Handbook on Leprosy. Orisa Mission Press, Cuttack, India (1921) 39.

[5] A chemical investigation of these oils will be reported in the near future.

[6] Goulding and Akers, Chem. Soc. Proc. 29 (1913) 197.

[7] Power, F. B., and Barrowcliff, M., Journ. Chem. Soc. 87 (1905) 897. The sample of "*Gynocardia odorata*" seeds obtained by Brill and Williams, Philip. Journ. Sci. § A 12 (1917) 211, from the Department of Agriculture at Assam was evidently *Taraktogenos* or *Hydnocarpus*. Since the external appearance of all these seeds is somewhat similar, it is important to note the easy distinction pointed out in Muir's Handbook, p. 39. The radical of the *Gynocardia* seed is lateral, while that of the *Taraktogenos* and *Hydnocarpus* is terminal.

[8] Unpublished work with tubercle bacilli by Dr. O. Schöbl, Bureau of Science.

The acids of this series are found nowhere else in nature, nor have they been synthesized in the laboratory. Expressed in terms of molecular structure, the distinguishing characteristic of these acids is that they contain a closed ring of five carbon atoms. All other known fatty acids have their carbon atoms in the form of an open chain. Due to this structural peculiarity, the acids of the chaulmoogric series have the power of optical rotation, and may be detected by the polariscope.

The nomenclature of the peculiar acids of chaulmoogra oil was initiated in 1879 by Moss,[9] who supposed chaulmoogra oil to be derived from *Gynocardia odorata*. He gave the name "gynocardic acid" to a crystalline preparation melting at about 29° C. This was later shown to be mixture, by Power and his collaborators,[10] who definitely isolated from chaulmoogra oil the acids which they named chaulmoogric and hydnocarpic. They considered the glyceryl esters of these acids, together with some palmitic, to be the chief constituents of chaulmoogra oil.

The fact that some *Hydnocarpus* oils are very similar to *Taraktogenos* oil has led to the claim that these may be legitimately sold as chaulmoogra oil. If the word chaulmoogra is to be defined by its original native meaning, this claim can hardly be denied; but the modern practice of standardizing medical terms necessitates the restriction of the word to *Taraktogenos kurzii*. The question of the medicinal value of the various *Hydnocarpus* oils must be decided on their own merits. Chemical investigation has shown that they are very similar to chaulmoogra oil and contain at least two of the same peculiar fatty acids which have been proved to be effective in the treatment of leprosy. The optical rotatory power is the best present single analytical criterion of this property, though the results of McDonald and Dean [11] indicate that the iodine absorption value is also important. The writer expects to publish an analytical study of various *Hydnocarpus* oils in the near future.

The clinical results on record are not confined to chaulmoogra oil; in fact, experts in India have in recent years preferred *Hydnocarpus wightiana* oil. This is encouraging to us in the Philippines, as we have no indigenous *Taraktogenos kurzii*, but

[9] Moss, Year-book of Pharmacy (1879) 523–533.

[10] Power and Gornall, Journ. Chem. Soc. 85 (1904) 838, 851; Power and Less, ibid. 87 (1905) 349; Power and Barrowcliff, ibid. 884; Barrowcliff and Power, F. B., Am. Journ. Pharm. 87 (1915) 493.

[11] McDonald, J. T., and Dean, A. L., Journ. Am. Med. Assoc. 76 (1921) 1472.

we have *Taraktogenos heterophylla* and a commercial supply of *Hydnocarpus*.

USE OF THE OIL IN THE TREATMENT OF LEPROSY

The use of chaulmoogra oil orally and externally in leprosy has so long been favored by the medical profession that it is not necessary to dwell on the detailed reports of beneficial results. Although its action has been so slow and uncertain that some physicians have had doubts of its efficacy, yet the consensus among them has been that chaulmoogra has a definite beneficial effect in leprosy, not produced by any other oil except perhaps the *Hydnocarpus* oils. This fact at once points to some specific effect of the peculiar fatty acids of chaulmoogra on the bacillus of leprosy. A remarkable confirmation of this idea is seen in the recent experiments of Walker and Sweeney,[12] who have demonstrated that the sodium salts of the chaulmoogra fatty acids are about one hundred times more bactericidal to acid-fast bacteria than is phenol. They further found that sodium salts of other fatty acids are practically inactive, and also that the action of chaulmoogra acids on acid-fast bacteria does not extend to other common pathogenic bacteria. They conclude (p. 259) that "any therapeutic action which chaulmoogra oil may have in leprosy is due to its direct antiseptic and bactericidal action on B. leprae." As to the "active principle" of the oil they decide that "the bactericidal activity is a function of the chaulmoogric acid series." To explain the specificity against acid-fast bacilli they propose the hypothesis that "these fat-elaborating bacilli attempt to utilize the chaulmoogric acids to build up their fatty capsules, and that these cyclic fatty acids contain a group or an arrangement of atoms which is toxic for the bacterial cell." Lastly, they conclude that this toxicity is unique with the chaulmoogric acid series, and not shown by the ordinary fatty acids; for example, those found in cod-liver oil.

While these four conclusions of Walker and Sweeney are based on extensive and careful experiments, they do not agree with opinions that have been based on clinical evidence. Practical experience in treating large numbers of lepers has led to various theories, of which those of Mercado and of Rogers, respectively, will be mentioned as examples.

Mercado explains the action of chaulmoogra oil as follows:[13]

[12] Walker and Sweeney, Journ. Inf. Dis. 26 (1920) 238.

[13] Mercado, E., Leprosy in the Philippines and its Treatment. Manila (1915) 55.

The organism repels the bacillary invasion due to the concurrence of a larger number of defensive elements as the leucocytes which possess phagocytic powers to destroy and exterminate the bacilli. In order that the organism may acquire a greater number of leucocytes for its defense, a stimulant or reactive is needed to provoke leucocytic hypergenesis, such as we are able to acquire from the presence and action of a fatty substance as the oil of chaulmoogra which also contains gynocardic acid, an alterative, acting upon the system as all other organic acids.

Other leprologists assume a similar, indirect effect.

Rogers, on the other hand, believes the effect to be direct, but not confined to chaulmoogra oil. He states [14] that there is nothing absolutely specific against leprosy in the products of chaulmoogra oil and—

that the sodium salts of the unsaturated fatty acids of these two oils [chaulmoogra and cod-liver oils] act in some way on the coating of the acid-fast bacilli, that of tuberculosis having been shown to contain palmitic and other unsaturated fatty acids. During the past year [1918] sodium morrhuate has been used with very promising results in tuberculosis by several careful observers to whom I have supplied it, and morphological changes have been noted in the tubercle bacilli in the sputum. A wide field of investigation has thus been opened out, as it appears to be possible that the organisms of other chronic diseases, including that of syphilis, might possibly be broken up in the system by similar methods.

By "sodium morrhuate" Rogers means the sodium salts of the principal fatty acids of cod-liver oil. He has later used successfully also ethyl esters made from cod-liver oil and sodium salts from soya-bean oil.[15]

The point which seems important to Rogers is that chaulmoogric and hydnocarpic acids are unsaturated; that is, they have the power of combining with iodine, bromine, hydrogen, and oxygen by direct addition of these elements; whereas a saturated fatty acid, like palmitic, for example, is comparatively inert chemically. Unsaturation is also a property of the acids in cod-liver, soya-bean, and many other oils.

While Rogers's theory is not supported by such definite experimental evidence as that of Walker, yet the fact remains that sodium morrhuate has an effect in leprosy and tuberculosis very similar to that of the chaulmoogra preparations. Walker's conclusions are therefore not strictly correct, but they at least furnish a scientific starting point toward the solution of the problem of leprosy treatment.

[14] Rogers, L., Brit. Med. Journ. 1 (1919) 147.
[15] Rogers, L., Ind. Med. Gaz. 55 (1920) 127.

METHODS OF TREATMENT BASED ON CHAULMOOGRA AND OTHER OILS

Until recently chaulmoogra oil was used principally in the crude form and was administered chiefly by mouth. The disadvantages of this method were that the nauseating properties of the oil seriously limited its use, and the action, even of large amounts, was slow. To obviate these difficulties, a number of other methods of administration were tried, in which the first real success was obtained by Mercado [13] who used the formula (p. 54):

"Camphorated oil 10 per cent
Chaulmoogra oil, pure and sterile } aa 60 c.c.
Resorcine ..... 4 grams.
Purified ether ..... 2.50 c.c.
Misc. Sig.: For intramuscular injection."

The camphorated oil is added because it "on account of its oils, helps the oil of chaulmoogra and besides that, it acts independently upon the heart and is at the same time, a recognized therapeutical agent which constantly increases phagocytic activity." Heiser states [16] that camphor and ether were suggested by the Merck Co., to assist in the absorption of the chaulmoogra oil. The resorcine was used for its antiseptic properties.

The intramuscular method is generally conceded as an advance on the oral administration of chaulmoogra oil, both because it avoids the nauseating effect and because it produces more-rapid results. The Mercado mixture has been found less irritating and is more easily absorbed than the pure oil injected in the same manner, although the pure oil, carefully prepared, is still injected intramuscularly in the asylums of Japan, where it is preferred on account of its more-concentrated form.

While the pure oil can be used intramuscularly, the crude commercial oil ordinarily sold is unsuited for such use, even though applied in the form of the Mercado mixture. A widespread idea that the crude oil is more efficacious has seriously interfered with the intramuscular treatment of leprosy. Heiser states:[17]

Experience with chaulmoogra oil at San Lazaro Hospital, when administered by mouth, has shown that the crude oil is much more efficacious than the refined product. When used hypodermically, there is apparently no difference whether the crude or the refined oil is used, but accurate data with regard to this point are not yet available.

[16] U. S. Pub. Health Rept. 29 (1914) 2765.
[17] Am. Journ. Trop. Dis. 2 (1914) 324.

The committee has made experiments using Mercado mixture prepared from chaulmoogra oil refined at the Bureau of Science, and from a high-grade oil made by Shiongi & Co., Osaka, Japan, which is either pressed from carefully selected seeds or else refined. In both cases it was found that the irritation was negligible as compared to that produced by the mixture made from ordinary commercial chaulmoogra oil. The free fatty acid was found to be one of the very irritating constituents of the crude oil. The fact that free fatty acid is more easily digested than neutral oil probably explains the superiority of the crude oil for oral administration.

Using the Mercado mixture as a standard for comparison, the committee has conducted experiments with seven newer preparations, all of which are designed for more-rapid absorption than occurs with the Mercado mixture. These are: Chaulmoogra ethyl esters, Muir's E. C. C. O., sodium gynocardate A, sodium gynocardate S, chaulmoogra emulsion, sodium morrhuate, and cod-liver ethyl esters. The composition and chemistry of each of these will be considered in turn.

CHAULMOOGRA ETHYL ESTERS [18]

The mixed ethyl esters of the fatty acids of chaulmoogra oil came on the market several years ago as "antileprol" [19] made by the Bayer Co. This was found by Mercado [20] to have no better effect than the oil when taken orally. Tests on two patients were made intramuscularly without results, but in these cases only 2 per cent and 5 per cent solutions were used.

The ethyl ester treatment has been used very successfully by Dean and his collaborators at Honolulu,[21] and the committee has obtained excellent results with it at San Lazaro Hospital.

The ethyl esters seem to be more easily absorbed than the oil, perhaps because they form a more-mobile liquid, which is easily emulsified. They have even been used intravenously by Muir.[22]

The method usually employed in making these ethyl esters seems to be to prepare the soap, then the fatty acids, and finally to esterify with the help of dry hydrochloric acid gas. The

[18] With the assistance of Mr. Ernesto Paras.

[19] Patents, D.R.P. 216,092, and B.P. 1984–1909, were granted for these ethyl esters, although Power had long before prepared them, and published accounts of his work.

[20] Op. cit. 43.

[21] McDonald and Dean, U. S. Pub. Health Rept. 35 (1920) 1959; Hollmann and Dean, Journ. Cutaneous Dis. 37: 367–373.

[22] Handbook on Leprosy. Orisa Mission Press, Cuttack, India (1921) 46.

writer has found this method cumbersome on the large scale, and at present esterifies the oil directly, with the help of sulphuric acid.

Ten kilograms of crude chaulmoogra oil, 13 liters of 95 to 96 per cent alcohol, and 750 cubic centimeters of 66° Bé. commercial sulphuric acid are placed in a 26-liter stoneware acid carboy which has been fitted with a sheet iron steam jacket and a large glass reflux condenser. A slow current of low-pressure steam is allowed to enter at the top of the jacket, provision being made at the bottom for escape of the condensed steam. The contents of the carboy are thus boiled gently for twenty hours.

The reaction that slowly takes place is the well-known one of interchange of alkyl groups under the influence of a mineral acid (hydrogen ion) catalyst. The glyceryl radical in the glycerides of the oil changes place with the ethyl group in the alcohol, forming the desired ethyl esters and glycerol.

The reaction product is syphoned into a large glass carboy, washed with about an equal volume of water and then with dilute caustic soda, just sufficient soda being added to produce a permanently alkaline reaction to phenolphthalein. The resulting emulsion separates fairly well after a few hours, and the upper layer is heated in a steam kettle to dry it.

This dry ester mixture is then distilled at about 50 millimeters pressure in a still made from a 30-centimeter (12-inch) length of 15-centimeter (6-inch) iron pipe capped and fitted with a reducing coupling. Gas heating has been used, but we have obtained a more-rapid output by the use of an electric heater (see Plate 1) and an electrically heated still head of 5-centimeter (2-inch) pipe, 150 centimeters (5 feet) long. Rolls of iron-wire netting are placed in the still head to prevent foaming over, which is the troublesome feature of this distillation. The heater is made from 20-centimeter (8-inch) stovepipe 45 centimeters (18 inches) long and 40-centimeter (16-inch) stovepipe 52 centimeters (22 inches) long, the space between the two walls being filled with asbestos fiber. The heating units are of No. 20 chromel A wire, 500 watts each, one flat coil at the bottom, three coils around the 20-centimeter stovepipe, and one coil around the still head. A Crowell 2–D vacuum pump has sufficient capacity for two of these stills.

The ester is allowed to enter the still by means of a tube running through the still head, in portions of about 200 cubic

centimeters, each portion being distilled before the next one is added. When properly adjusted the still delivers at the rate of 4 liters an hour. After about 50 liters have been distilled the still head is taken off and the accumulated pitch cleaned out from the body of the still. Solvents are not very effective, so the pitch is liquefied by heat and removed by mechanical means.

The distilled esters contain volatile impurities which were found to be irritating. They are therefore placed in a stoneware carboy and agitated vigorously by a current of steam for two hours. Sometimes we wash the esters again with alkali at this point, but as the free fatty acid is seldom more than 1 per cent this step is generally omitted. In either case the product is freed from the accompanying water in a separatory funnel, and then filtered. The clear, almost colorless, filtered esters are next placed in small bottles, loosely corked, and heated to 150° C. Each cork is then pushed down and paraffined. In this form the ester is ready for use.

The ethyl ester is used not only in the pure form but also mixed with 2 per cent iodine, which is the standard preparation used by McDonald and Dean. The iodine is added to the dry ester, in which it gradually dissolves, combining chemically.

We recover alcohol from the first washings mentioned above by neutralizing with lime, and fractionating through an iron pipe 240 by 15 centimeters (8 feet by 6 inches) filled with broken glass. The alkaline wash water is collected in a barrel and acidified to break the emulsion. A mixture of ester and fatty acid rises to the top, and is skimmed off for reësterification along with another batch of oil. About 5 per cent requires reësterification in this manner.

The theoretical yield of ethyl ester is 1.05 kilograms per kilogram of chaulmoogra oil. A small amount of the oil remains as glyceride, which, along with unknown impurities and decomposition products from the ethyl ester, account for the accumulation of tar in the still. The amount of glyceride is low, and the decomposition of ethyl ester is also very small if a good vacuum is maintained. Under average working conditions 50 kilograms of oil have been found to give 2 kilograms of residue in the still. Together with the usual mechanical losses in handling, this cuts down our working yield to 90 or 95 kilograms of finished ester per 100 kilograms of chaulmoogra oil.

COMPARISON OF HYDROCHLORIC ACID WITH SULPHURIC ACID AS CATALYST

Strong sulphuric acid has a tendency to form addition products with unsaturated compounds, and is known to react with chaulmoogra oil. In order to ascertain whether such undesirable action takes place under the conditions which we use for the esterification, experiments have been conducted comparing the sulphuric acid catalysis with that of hydrochloric acid, which does not have a similar combining power. The results of typical parallel experiments are shown in Table 1. In this case 1 liter of 95 per cent sulphuric acid instead of the usual 750 cubic centimeters of 93 per cent was employed as catalyst, and boiling was continued for forty-one hours to intensify the effect. The control experiment was done in the same manner, but instead of adding sulphuric acid dry hydrochloric acid gas was passed into the alcohol until it showed 5 per cent by titration. Thirteen liters of 96 per cent alcohol and 10 kilograms of oil were used in each experiment. The oil was presumably pure *Taraktogenos*, being guaranteed by the maker, P. K. Sen, of Chittagong.

TABLE 1.—*Comparison of hydrochloric acid with sulphuric acid as catalyst.*

	Chaulmoogra oil.	Ester washed with water.		Distilled ester.	
Catalyst		HCl	H_2SO_4	HCl	H_2SO_4
Specific gravity 30/4° C	0.947			0.890	0.891
Refractive index 30° C. D line	1.4767	1.4575	1.4570	1.4568	1.4566
Optical rotation, D, 100 mm	46.0	40	38	38.1	38.9
Iodine No., Hanus	102	93	94	97.5	97
Saponification No	198	187	190	187	188
Acidity, as per cent oleic	13.8	4.4	2.1	1.38	0.51
Freezing point of fatty acids, °C	29	29	30	30	31
Specific rotatory power of fatty acids dissolved in xylene	47.7	46.8	47.3	45.5	45.5

The data given in Table 1 show that sulphuric acid, under the given conditions, does not appreciably change the chaulmoogra fatty acids. The figures for the rotation of the washed esters are approximate, as they were too dark for accurate determination. The optical rotation of the hydrochloric acid esters decreased somewhat upon distillation. This decrease has been noted to occur when distillation is delayed by accidental difficulty with the vacuum, which happened in this run. The

same may be said of the occurrence of free fatty acids in the distilled product. They were produced during distillation and have no relation to the free fatty acids in the crude products, as these were washed thoroughly with alkali before distillation.

The iodine numbers of the esters and the rotatory powers of the fatty acids show clearly that the use of sulphuric acid as a catalyst is permissible, even on long boiling. Sulphuric acid has obvious economical advantages as compared with hydrochloric acid gas and reduces, by its hygroscopic action, the amount of free fatty acid in the crude esters.

MUIR'S E. C. C. O.

The preparation and use of this mixture is described in Muir's Handbook on Leprosy, page 43. It is composed of *Hydnocarpus wightiana* ethyl esters, 1 cubic centimeter; double distilled creosote, 1 cubic centimeter; camphor, 1 gram; olive oil, 2.5 cubic centimeters. The committee has recently placed a group of patients under treatment with this drug.

SODIUM GYNOCARDATE A

This is the derivative of chaulmoogra oil used for subcutaneous and intravenous injection since 1917 by Leonard Rogers.[23] Recently he has called it sodium hydnocarpate,[24] but as it is really a mixture containing a large amount of sodium chaulmoograte there seems to be no good reason for changing the name. The name "gynocardate" has always been applied to a similar mixture, while "hydnocarpate" applies to a definite chemical individual. To prepare this drug, chaulmoogra oil is saponified by boiling it in a steam kettle with about four parts of water, adding one-fifth part of caustic soda in small portions. The fatty acids, which solidify at about room temperature, are liberated by the addition of sulphuric acid, then dried, and dissolved in alcohol. The solution is cooled in a refrigerator, which causes the less-soluble acids, particularly chaulmoogric, to crystallize out.

Several fractions are crystallized out, and the least soluble is mixed with sufficient of the intermediate fractions to give a product melting at 48° C. This, after neutralization with caustic soda, is a duplication of Rogers's preparation, as closely as can be ascertained.

[23] Rogers, L., Ind. Journ. Med. Res. 5 (1917) 277.
[24] Rogers, L., Ind. Med. Gaz. 54 (1919) 165.

Sodium gynocardate A is used in the form of 3 per cent sterilized solution, containing 0.5 per cent phenol, and 0.5 per cent sodium citrate to avoid clotting.

SODIUM GYNOCARDATE S

This preparation was made in the same manner as sodium gynocardate A, except that the total fatty acids instead of the crystallized acids were employed. As the preparation was found to be irritating, the committee soon decided to use in its place a similar solution (sodium gynocardate D) differing only in that the fatty acids have been purified by distillation in vacuum. The irritating substances are thus removed to a large extent.

CHAULMOOGRA EMULSION

About the time that Rogers was beginning the intravenous injection of chaulmoogra soap solutions, Vahram [25] was using a very fine emulsion of chaulmoogra oil in the same manner. A mixture of the oil with 20 parts by weight of acacia was desiccated to cause intimate union, and then mixed with 1,390 parts of water, forming a very dilute emulsion. This preparation is now on the market as "Collobiasis of Chaulmoogra," made by the Laboratoires Pharmaceutiques de Dausse, Paris. This "Collobiasis" has been used by the Committee on Leprosy Investigation for direct infiltration in the lesions and, to a smaller extent, intravenously. A similar chaulmoogra emulsion, prepared at the Bureau of Science, has also been used for infiltration.

SODIUM MORRHUATE

Cod-liver oil has not been used to any large extent in leprosy, but it has had wide application in the treatment of tuberculosis. It was probably for this reason that Rogers [26] chose cod-liver oil as a basis for a preparation similar to sodium gynocardate for use in tuberculosis. The new drug, which he named sodium morrhuate, has given good results in the treatment of this disease, and even better results in the treatment of leprosy.

The composition of cod-liver oil is very complex. It contains glyceryl esters of the common fatty acids, palmitic, stearic, and oleic, together with a number of characteristic fish-oil acids

[25] Vahram, M., Progrès Médical (1916) 19. New Orleans Med. and Surg. Journ. 69: 230.

[26] Rogers, L., Ind. Med. Gaz. 53 (1918) 73.

(clupanodonic and others) which have not been so fully investigated.[27] These characteristic acids all have the property of unsaturation, which has been previously discussed in connection with chaulmoogra oil.

The sodium morrhuate used in the experiments of the Committee on Leprosy Investigation has been prepared by Rogers's method.[28]

This consists in making the sodium soap of cod-liver oil and extracting with ether to remove irritating substances. A 3 per cent solution has been used, principally by intravenous injection.

COD-LIVER OIL ETHYL ESTERS

This preparation has been recommended by Rogers [29] as being less irritating than chaulmoogra ethyl esters. The committee obtained the opposite result, probably because of differences in the methods of preparation. The addition of 2 per cent iodine, however, seems to destroy the irritating constituents, so this mixture is now being used by the committee.

CONCLUSION

In conclusion, the writer wishes to point out that the success recently attained in the treatment of leprosy and tuberculosis with drugs derived from certain oils is encouraging, not only in itself but also in the prospect for improvement that it promises. If Walker's idea of the absorption of toxic fatty substances by acid-fast bacilli is correct, it should be easy to make in the laboratory a much more effective drug by properly combining a toxic element like arsenic or antimony with a fatty acid. If Rogers's idea of the efficacy of unsaturation in general proves to be correct, oils may be used that are much more unsaturated than chaulmoogra oil. The conclusions as to the value of the various drugs described above must of course be deferred to the medical report of the committee, but it may be stated that the intramuscular ethyl ester treatment has been decided upon for the main routine treatment at Culion Leper Colony. About 200 liters (40,000 doses) per month are now being manufactured at the Bureau of Science for that purpose.

[27] Lewkowitsch, J., Chemical Technology and Analysis of Oils, Fats & Waxes. London 2 (1914) 424.

[28] Rogers, L., Brit. Med. Journ. 2 (1919) 426; Ind. Journ. Med. Res., Special number, 7 (1919) 238.

[29] Rogers, L., Ind. Med. Gaz. 55 (1920) 127.

SUMMARY

1. Recent developments in leprosy treatment are discussed from a chemist's viewpoint.

2. The manufacture of chaulmoogra ethyl esters is described in detail.

3. The preparation of six other drugs, mostly following the procedure of other investigators, is described, these being the other medicines chosen by the Committee on Leprosy Investigation for experimental treatment.

ILLUSTRATION

Plate 1

A portion of the Bureau of Science leprosy-drug plant, showing vacuum distillation of ethyl ester.

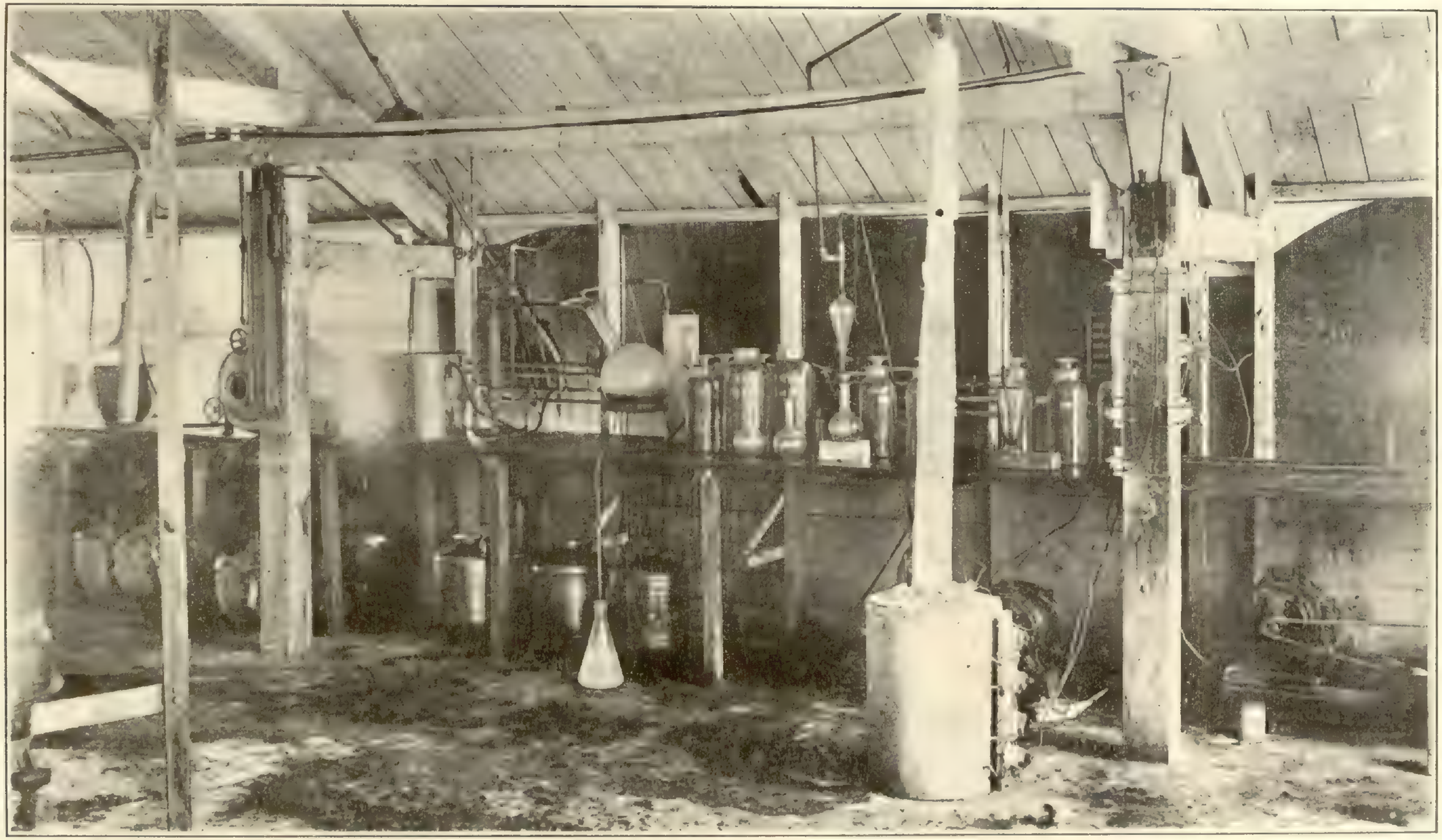

PLATE 1. VACUUM DISTILLATION OF ETHYL ESTER AT THE BUREAU OF SCIENCE

MANUFACTURE OF INDUSTRIAL ALCOHOL AND ALCOHOL MOTOR FUEL IN THE PHILIPPINE ISLANDS

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ONE PLATE AND THREE TEXT FIGURES

INTRODUCTION

Alcohol has been used for beverage purposes in the Philippine Islands since the earliest times. The production of alcohol for beverage and other purposes constitutes at the present time a very important industry, as is readily seen from Table 1 which shows the amounts of denatured (industrial) alcohol and fermented liquors produced annually from 1909 to 1920, inclusive.

TABLE 1.—*Distilled liquors and malt beverages manufactured in the Philippine Islands and the taxes collected upon them.*

Fiscal year.	Distilled spirits.		Denatured alcohol.	Fermented liquors.
	Manufactured.	Tax collected.		
	Proof liters.[a]	*Pesos.*[b]	*Proof liters.*	*Gauge liters.*
1909	9,532,537	1,899,043	26,672	3,636,499
1910	10,584,124	2,269,160	183,682	3,837,000
1911	10,471,299	2,551,501	380,099	3,887,500
1912	11,426,728	2,713,061	[c]721,262	4,466,250
1913	11,276,298	2,658,066	661,790	3,663,750
1914	11,847,354	2,729,705	820,148	3,915,000
1915	7,164,723	2,243,499	801,428	3,667,703
1916	10,350,363	2,747,396	735,753	5,720,769
1917	15,073,758	4,189,503	966,549	5,875,200
1918	15,931,402	4,476,443	867,971	4,236,200
1919	13,413,612	4,318,895	633,217	4,378,800
1920	16,019,612	3,976,938	[d]522,412	5,221,865

[a] Includes denatured alcohol exported tax free and medicinal tax-free alcohol. The proof spirit referred to throughout this article is that fixed by section 3249 of the Revised Statutes of the United States which defines proof spirit as containing one-half its volume of alcohol of a density 0.7939 at 60° F. The British proof spirit contains 49.24 per cent alcohol by weight.

[b] One peso Philippine currency equals 50 cents United States currency.

[c] Includes tax-free alcohol used for medicinal purposes.

[d] Exempt from specific tax but subject to 1 per cent on gross sales.

A large increase in the production of industrial alcohol can be confidently looked forward to, mainly because alcohol mixtures are being used in internal-combustion engines as fuel to replace gasoline. Incidentally, there is always the possibility of prohibition being extended to the Philippines, which would result in decreased production of beverage alcohol and increased production of industrial alcohol.

It is not the purpose of this article to discuss the production of alcohol for beverage purposes. On the other hand, a great deal of the information given applies to the manufacture of beverages from the rectified alcohol as well as to the manufacture of industrial alcohol and alcohol mixtures for motor fuel.

RAW MATERIALS FOR THE PRODUCTION OF ALCOHOL

The largest source of raw material for the production of alcohol in the Philippine Islands is undoubtedly the saps of the various native palms; of these, the sap of the nipa palm is most used. Another large source of alcohol is the molasses obtained as a by-product in the manufacture of sugar from sugar cane. Various cereals, cassava, bamboo, and other cellulose materials are also potential sources of alcohol. In fact, the potential sources of alcohol in the Tropics are illimitable, as can be readily appreciated by any person who has traveled in tropical countries. Table 2 shows the quantity and kind of raw material used in the production of alcohol in the Philippine Islands and the amount of alcohol produced during 1919 and 1920.

TABLE 2.—*Quantity and kind of raw material used in the production of alcohol in the Philippine Islands in 1919 and 1920.*

Source of alcohol.	1919		1920	
	Quantity used.	Proof alcohol produced.	Quantity used.	Proof alcohol produced.
	Liters.	*Liters.*	*Liters.*	*Liters.*
Nipa sap	57,770,157	5,887,208	51,730,608	5,148,315
Coco sap	3,500,159	456,980	4,309,671	525,643
Molasses	11,004,256	6,778,878	18,058,566	9,078,297
	Kilos.		*Kilos.*	
Hard molasses	----------	----------	1,373,925	924,888
Cane sugar	501,347	273,377	516,979	326,844
Grain	2,775	481	3,996	1,921
	Liters.		*Liters.*	
Others	18,728	16,688	16,206	13,275
Total production	----------	13,413,612	----------	16,019,183

In 1910, 93 per cent of the total amount of alcohol and alcoholic beverages produced in the Philippine Islands was distilled from

the sap exuding from palm trees. In 1920, this value had fallen to 35.4 per cent, due mainly to the increased use of molasses. The utilization of palm saps at present is confined to a few small areas. There are great tracts well situated for exploitation which have not yet been touched. The cost of production of alcohol from various sources is given in Table 3.

TABLE 3.—*The cost in dollars,*[a] *United States currency, of the various kinds of raw materials required to produce alcohol.*[b]

	Cost of the raw material required to produce 1 liter.	
	100 proof.	180 proof.
Sugar beets at 5 dollars a ton; sugar content, 14 per cent.	0.032	0.058
Sorghum stalks at 3 dollars per ton	0.032	0.059
Sugar cane at 3.25 dollars per ton	0.028	0.050
Beet molasses at 15 dollars per ton	0.029	0.053
Cane molasses at 0.12 dollar per gallon[c]	0.032	0.059
Jerusalem artichokes at 5 dollars per ton	0.027	0.048
Cassava at 5 dollars per ton	0.019	0.034
Potatoes at 4 dollars per ton for culls	0.021	0.037
Sweet potatoes at 8 dollars per ton	0.031	0.056
Barley at 0.65 dollar per bushel of 48 pounds	0.041	0.074
Maize at 0.70 dollar per bushel of 56 pounds	0.037	0.066
Oats at 0.35 dollar per bushel of 32 pounds	0.046	0.082
Rye at 0.80 dollar per bushel of 56 pounds	0.051	0.092
Nipa at 0.00389 dollar per liter,[d] equivalent to 6.5 per cent alcohol	0.015	0.027
Coco at 0.005 dollar per liter, equivalent to 6.5 per cent alcohol	0.0384	0.069
Coco at 0.0062 dollar per liter, equivalent to 6.07 per cent alcohol	0.0488	0.088

[a] One dollar United States currency is equal to 2 pesos Philippine currency.

[b] From Bull. U. S. Dept. Agr., Bur. Chem. **130** (1910); nipa and coco data from Gibbs, Philip. Journ. Sci. § A **6** (1911) 104.

[c] The present price of molasses (February, 1922) is 3 centavos (1.5 cents) a gallon.

[d] Pratt, D. S., Philip. Journ. Sci. § A **8** (1913) 395, estimates cost of nipa at 0.0015 dollar per liter, which gives less than one-half the value computed for cost of alcohol from nipa tuba given in the above table.

MOLASSES

Among the waste products utilized for the manufacture of alcohol, molasses ranks first. In the United States the chief source of industrial alcohol is cane or black-strap molasses. This product has been used for the manufacture of West Indian rum for more than two hundred years, but the utilization of molasses in large quantities for the production of industrial alcohol is a development of the last few years. For the manufacture of alcohol, molasses far surpasses any other material except palm saps in the ease with which it can be manipulated. Some 300,000,000 gallons of molasses are annually available in the West Indies. Tank steamers carry this material to the distil-

leries located in New York, Boston, Baltimore, New Orleans, and other manufacturing centers. In 1920, 110,000,000 gallons of molasses were used for the production of industrial alcohol in the United States.

The Philippine Islands sugar crop of 1921 totaled 552,027 tons.[1] The molasses weight is about 25 per cent of the weight of the sugar produced. This gives an annual production of 23,000,000 gallons of molasses.[2] Only 20 per cent of this was utilized for alcohol. Practically no alcohol was made at the centrals, the molasses being transported to the distilleries, mostly in or near Manila. Molasses is at present being run to waste in some sugar centrals because of a lack of market for it. Negros Island alone produces annually 8,000,000 gallons of molasses. Production will undoubtedly be largely increased in the future.

It takes from 2.5 to 3 gallons of molasses (depending chiefly on the percentage of sugar in the molasses and on the efficiency of the plant) to make 1 gallon of 190° proof (95 per cent) alcohol. At the latter conservative figure, the present annual supply of molasses in the Archipelago is a potential source of approximately 7,800,000 gallons of alcohol. Besides the fermentable sugar, cane molasses also contains valuable salts which can be utilized for fertilizer. In fact, the price of molasses is largely based on its fertilizing value. As far as the writer can ascertain, no attempt is being made in the Philippine Islands to recover the nitrogen, potash, and phosphorus compounds contained in the lees in the manufacture of alcohol from molasses. Theoretically, if the ash of the burned bagasse and the salts of the molasses are returned to the soil, the latter suffers no loss, as the sugar formed consists of carbon, hydrogen, and oxygen, which can be obtained from air and water.

The potash and nitrogen content[3] is greater in Hawaiian molasses than in Philippine molasses, as is shown in Table 4.

TABLE 4.—*Fertilizer constituents of Philippine and Hawaiian molasses.*

Constituent.	Philippine.	Hawaiian.
	Per cent.	*Per cent.*
Potash	1.39	3.99
Phosphorus	0.38	0.21
Nitrogen	0.21	0.64

[1] Commercial ton (2,000 pounds). One metric ton equals 1.1 commercial tons.

[2] One United States gallon equals 3.78 liters. One gallon of molasses weighs 12 pounds.

[3] Brill, H. C., and Thurlow, L. W., Philip. Journ. Sci. § A 12 (1917) 269.

The Hawaiian cane takes up more of these constituents, because the quantity available is greater due to the general use of fertilizers in the Hawaiian Islands. In many cases no fertilizer is added to the sugar lands of the Philippine Islands, and no attempt is made to return the fertilizer ingredients found in the ash of the bagasse and in the molasses. Thus, it is only a question of years before fertilization must be practiced or the land will become exhausted.

Fermentation of the molasses.—The methods of fermentation of molasses in the Philippines are crude, with consequent low efficiencies resulting. There is no distillery using modern yeast-culture machines and very few in which the dilution of the wort, the addition of acid and sulphate, the stopping of the fermentation at the highest alcohol content, etc., are scientifically controlled. Brill and Thurlow [4] have shown that sterilization of the molasses solution or the use of good water increases the efficiency markedly. Also the dilution of the molasses to a definite density (about 16.5 Brix) is essential. The addition of 2 grams of sulphuric acid and at least 0.4 gram of ammonium sulphate to every liter of ferment will increase the percentage of alcohol produced. The use of pure yeast culture is probably the greatest factor in obtaining the highest possible efficiency. They recommend 1 part of pure yeast-fermenting wort to 100 or 150 parts of ferment. The dilution of the molasses may be decreased by using the Molhant process of accustoming the yeast to fermenting in more highly concentrated solutions, with a consequent saving in heat necessary for distillation. Magné [5] cites the following figures with reference to the yield of alcohol according to the process employed:

TABLE 5.—*Yield of alcohol from molasses according to the process employed.*

Method of fermentation.	Yield of alcohol; per cent of theoretical.	Absolute alcohol per 100 pounds fermentable sugar.	Molasses (55 per cent fermentable sugar) necessary for 1 gallon absolute alcohol.
		Gallons.	*Gallons.*
Spontaneously in presence of wild yeast	40–60	2.9–4.4	3.5–5.4
Using compressed yeast	50–75	3.6–5.5	2.8–4.2
Using antiseptics	70–85	5.1–6.2	2.5–3.0
Operating with pure yeast	85–95	6.2–6.9	2.2–2.5

[4] Loc. cit.

[5] Magné, J., Pamphlet on the Manufacture of Alcohol from Molasses and Cane Juice. New Orleans, La., U. S. A.

It is quite possible to obtain a yield of 85 or 90 per cent, yet 75 per cent is considered good practice in the Philippine Islands. Any improvement in the methods of fermentation and distillation of molasses would mean an increase of revenue to the Islands and larger profits to the manufacturer.

Other raw materials for the production of alcohol.—Any starch or cellulose material can be converted into alcohol by proper treatment; consequently, the raw materials for the production of alcohol, in the Tropics at least, are practically inexhaustible. Bamboo, cassava, the various palms, wood waste (sawdust), etc., can all be utilized; however, the nipa sap and waste molasses available will more than meet the demand for the next few years.

The yields of alcohol from various sources, given in Table 6, are what may be expected in large-scale production.

TABLE 6.—*Approximate yield of alcohol from various sources.*

Material.	United States gallons of 95 per cent alcohol per ton of 2,000 pounds.[a]
Sugar molasses	70
Sorghum stalks	13.5
Wheat	100
Barley	75
Potatoes	21.5
Sweet potatoes	37.5
Cassava	42
Bananas	14
Sawdust (soft woods)	21.5

[a] One United States gallon equals 3.78 liters.

Inorganic sources of alcohol.—The commercial production of alcohol from inorganic materials is a recent achievement. The general method involves the hydrogenation of acetylene to form ethylene, which is then dissolved in sulphuric acid; this mixture, containing ethyl hydrogen sulphate, is diluted and distilled, alcohol being given off. A cheap source of power is necessary to make such a process a commercial success. A plant for the production of alcohol by this method is now in operation in Switzerland. The process is not a feasible one for the Philippine Islands at present.

ALCOHOL AND ALCOHOL MIXTURES AS FUELS FOR INTERNAL-COMBUSTION ENGINES

Although the application of alcohol as a fuel for internal-combustion engines dates back more than two decades, it is only within the last four or five years that the problem has

assumed practical importance. This is due to the enormous increase in the use of automobiles in the last decade and the world-wide application of crude oil to transportation. The powers of the world are even now engaged in a struggle to monopolize the available supplies of crude oil, for our present-day commerce is dependent very largely upon an adequate supply of oil.

In the United States alone the production of crude oil has increased about 140 per cent since 1909, and that of gasoline about 800 per cent; but the number of automobiles registered has risen 2,570 per cent. The consequent enormous demand for gasoline has been met, partly by increasing the boiling-point range, partly by extracting liquid hydrocarbons from natural gas, partly by cracking, and partly from stored reserves. According to the United States Geological Survey [6] the unmined supply of petroleum is, roughly, 6,000,000,000 barrels which, if the present rate of production is maintained, will be exhausted in about thirteen years. But the present rates of production and of consumption will undoubtedly be increased, thus bringing even closer the exhaustion of our oil supply. Therefore, the finding of a substitute for gasoline is of utmost, vital, and immediate importance. We must find some less-evanescent fuel, one that is inexhaustible or almost so. There is known at present only one; namely, alcohol.

The pioneer experimental work on the production of an efficient alcohol engine has been completed.[7] It has been found that in order to use alcohol efficiently, the following alterations in the present type of engine are necessary:

Increased compression.—Alcohol is more efficient in engines of low piston speed and long stroke. This is due to the slower flame propagation of alcohol vapor in comparison with gasoline vapor and its ability to stand higher compression (180 pounds per square inch) without preignition.

Preheating of air and alcohol vapor.—Alcohol will not vaporize at ordinary temperatures. The preheating necessary can be readily done by utilizing the exhaust, with an electrical contrivance for starting from the cold.

[6] Mineral Resources of the United States, pt. 1 (1917).

[7] See Lucke, C. E., and Woodward, S. M., Tests on internal combustion engines on motor fuels, Bull. U. S. Dept. Agr., Off. Exp. Sta. 191 (1907). Strong, R. M., Commercial deductions from comparison of gasoline and alcohol tests on internal combustion engines, Bull. U. S. Geol. Surv. 393 (1909).

Reduced water-cooling circulation.—Alcohol does not give out as much heat in burning as gasoline, but needs high cylinder temperatures for efficient working.

Increased jet orifice of carburetor.—An alcohol engine needs the jet orifice enlarged so as to increase the fuel supply about 50 per cent.

Carburetor floats.—Either a metal float or a cork float having a baked coating of boiled linseed oil should be used instead of a shellac-coated float, as shellac is soluble in alcohol.

It is thus readily seen that alcohol cannot immediately replace gasoline. A fuel which can be used in the present type of engine is necessary to tide over the transition period during the change from gasoline to alcohol engines. Such a fuel is a mixture of alcohol with a more-volatile substance, such as benzol or ether.

ALCOHOL MIXTURES

Mixtures of alcohol with other substances have been in use for some time. The mixture most used in Europe is one of alcohol and benzol. The use of benzol makes the fuel dependent on a coal-tar industry, and such countries as South Africa, Australia, South America, the Philippines, etc., would have to import their benzol. Consequently there has been developed in South Africa and in Hawaii a mixture of alcohol and ether; since the ether is made from the alcohol, its manufacture is practically independent of any other industry.

In South Africa a fuel named "Natalite," or "Natilite," has come into wide use due to the scarcity and the high cost of gasoline during the World War. It has been patented in all countries throughout the world. This mixture contains 55 per cent of rectified alcohol, 44.9 per cent of ether, and 0.1 per cent of ammonia. In 1918 over 255,000 gallons of Natalite were produced from molasses in South Africa. At the present time the largest factory is at Merebank, Natal, the capacity of which has been increased to 2,000,000 gallons per annum.

In 1918, due to the scarcity of gasoline in Hawaii, there was developed by Mr. Foster, of the Maui Agricultural Co., a motor fuel very similar to Natalite which has been used very successfully in the place of gasoline. It consists of a mixture of 55.55 per cent alcohol, 42.78 per cent ether, 1.11 per cent kerosene, and 0.56 per cent pyridine; that is, 40 gallons of ether are added to 60 gallons of Formula No. 3 [to each 100 gallons ethyl alcohol add 5 gallons sulphuric ether, 2 gallons benzine (kerosene), and 1 gallon pyridine].

With either of these mixtures, ether being very volatile, the engine can be started even more easily than with gasoline. The pyridine or ammonia is added to neutralize any acids that might be formed in the fuel or in the combustion of the fuel, and it also serves as a denaturant.

These mixtures compare very favorably with gasoline in efficiency. That these fuels can even now compete with gasoline for airplane engines in the United States, where gasoline costs less than one-half what it does in the Philippines, is demonstrated by the United States Post Office Department [8] in its airplane mail service. Its tests show "a great increase in number of miles per gallon, an increase in power and a very marked saving in the quantity of lubricating oil used."

Table 7 shows the consumption of alcohol fuel at various speeds, the tests covering thirty-one nonstop flights between New York and Washington.

TABLE 7.—*Consumption of alcohol fuel in airplane engines at various speeds.*

Revolutions per minute.	Gallons per hour, alcohol mixture.
1,440–1,460	15.9
1,475–1,480	20.1
1,500	21.5
1,520–1,525	22.4

Tables 8 and 9 show the amounts of gasoline and alcohol fuel used by airplanes at varying speeds, and also the consumption of lubricating oil.

TABLE 8.—*Comparison of the consumption of gasoline and alcohol fuel in airplane engines at varying speeds.*

Revolutions per minute.	Gallons per hour.	
	Gasoline.	Alcohol mixture.
1,440–1,460		15.9
1,475	24	20.1
1,500	24.17	21.5

These tests also proved that there was much less carbon formation when using alcohol fuel than when using gasoline, and the number of forced landings due to fouled spark plugs was reduced to the minimum.

[8] Tunison, B. R., Chem. & Met. Eng. 22 (1920) 297.

TABLE 9.—*Comparison of the consumption of lubricating oil in airplane engines with gasoline and with alcohol fuel.*

Revolutions per minute.	Oil used with—	
	Gasoline.	Alcohol mixture.
1,440–1,460		4.5
1,475	4.65	4.2
1,500	4.95	

These alcohol mixtures have been thoroughly tested, and they compare very favorably with gasoline.[9] The mileage obtained is equal or superior to that obtained with gasoline; there is no carbon deposit left in the cylinder; the acids formed are neutralized by the pyridine or ammonia present, hence there is no corrosion; there is less tendency toward knocking, resulting in a smoother-running engine; the heat of combustion is lower, hence the engine is less liable to overheat; in case of fire it can be extinguished with water; an engine can be started more easily from the cold than with gasoline; there is less fouling of the spark plugs and lower consumption of oil.

Foster [10] points out that the addition of substances that would neutralize the acids formed by the explosive combustion of the alcohol-ether fuel has incidentally often resulted in retarding the production of corrosive compounds within the fuel itself. He states in his patent:[11]

> It is obvious that the production of a successful synthetic fuel for internal combustion engines involves not only the problem of protecting the engine from the products of combustion, but the far more involved problem of protecting the fuel itself from destructive action and the fuel storage and supply system from the deleterious effects resulting from such auto-destructive action of the fuel.

The use of ammonia as a neutralizing agent in alcohol-ether mixtures is open to the great objection that ammonia is very volatile. To obtain some idea of the rate of evaporation of ammonia the following experiment was carried out: An alcohol-ether-ammonia mixture of the same composition as Natalite was placed in open 60-cubic-centimeter beakers, 25 cubic centimeters in each beaker. The ammonia present was de-

[9] Alcohol used alone is, of course, more efficient than are alcohol mixtures, when used in slow-speed engines with high compression.

[10] Sugar News 2 (1921) 524.

[11] United States patent 1,384,946.

termined at certain time-intervals by titration with tenth normal hydrochloric acid. Litmus paper was used as an indicator, 20 cubic centimeters of distilled water being added to the sample before titration. The results are shown in Table 10.

Text fig. 1 shows the rate of loss of ammonia from Natalite fuel when exposed to the atmosphere. It is readily seen that a less-volatile alkaline substance than ammonia must be used as a neutralizing agent. Of the many possible compounds the

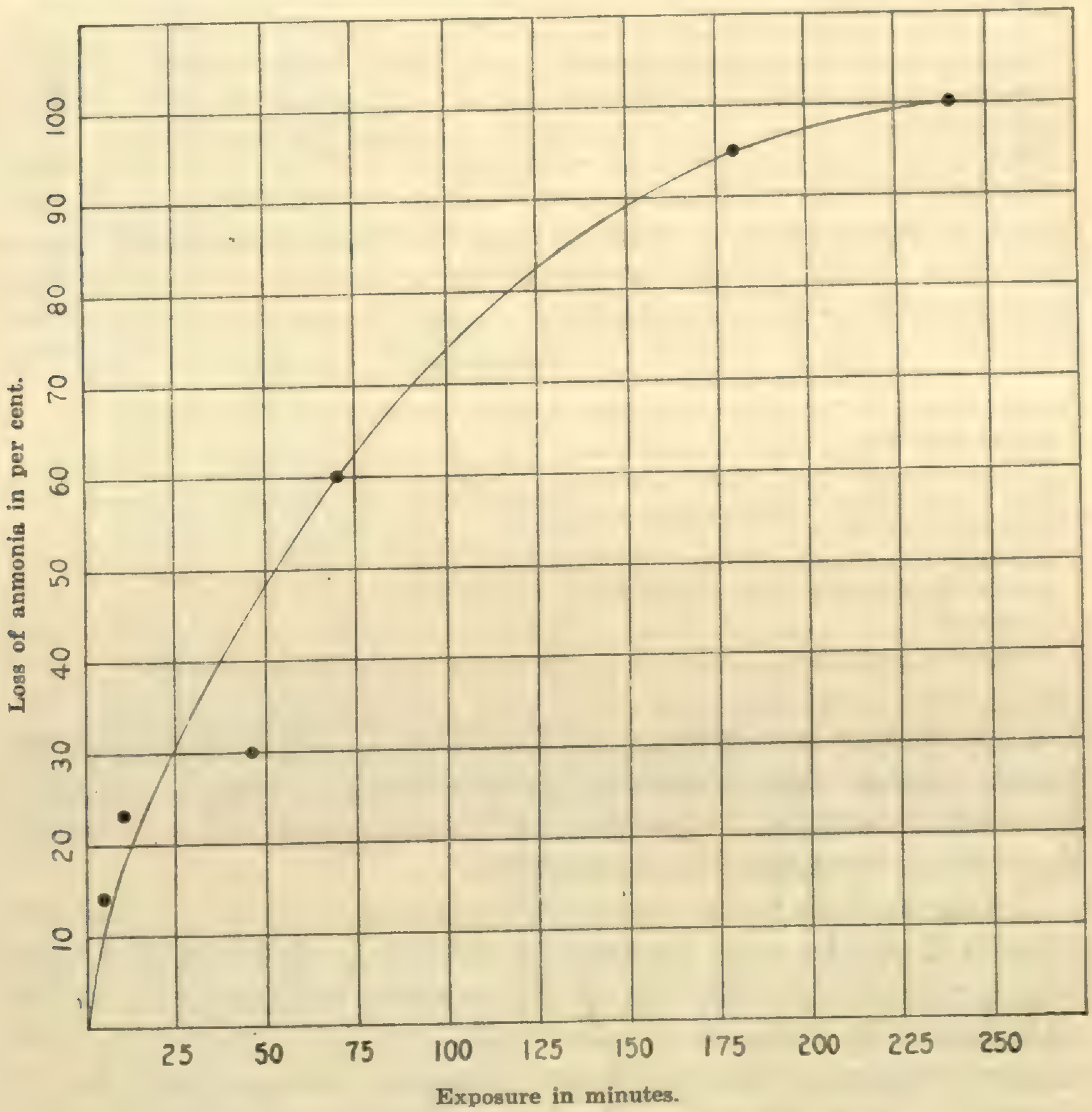

FIG. 1. Percentage loss of ammonia from Natalite fuel.

only ones that are obtainable in large quantities and that are at the same time inexpensive are pyridine and aniline.

The writer has tested both Natalite and Foster's fuel in a Buick-Six model automobile. The shellac-coated cork float was replaced by one coated with glue. The spark was advanced to 30°. The air-fuel mixture was carefully adjusted. Table 11 shows comparative results with these fuels.

TABLE 10.—*Determination of the rate of evaporation of ammonia from a Natalite mixture exposed to the air. Temperature, 28° C.*

Duration of exposure to air.	0.1 *N* hydrochloric acid equivalent to 25 cc. of mixture.	Ammonia in 100 cc. of mixture.	Loss of ammonia.
Mins.	*cc.*	*mgs.*	*Per cent.*
0	4.3	29.3	
5	3.7	25.2	14.0
10	3.3	22.5	23.0
30	2.3	15.7	46.4
60	1.3	8.9	69.6
180	0.2	1.4	95.2
240	0.0	0.0	100.0

TABLE 11.—*Comparison of Shell gasoline with Natalite and with Foster's motor alcohol.*

	Shell gasoline.	Natalite,	Foster's motor alcohol.
Miles per gallon	13.6	11.9	12.0
Oil used	Mobiloil Arctic.	Mobiloil Arctic.	Mobiloil Arctic.
Ease of start from the cold	Must be choked.	Starts readily	Starts readily.
Knocking under strain	Slight	None	None.
Pick up	Good	Good	Good.
Carbon formation in the combustion chamber	Marked	Slight	Slight.
Condition of spark plugs	Sooted	Clean	Clean.

Trouble was experienced at first due to clogging of the carburetor from dirt loosened by the motor alcohol. After a thorough cleansing of storage tank, vacuum tank, and carburetor, no further trouble was experienced.

If this fuel is to be successfully launched in the Philippine Islands it will be only the part of wisdom to insist upon a thorough preliminary cleansing of the gasoline system and a proper adjustment to both the fuel-air mixture and the spark. The normal setting of the spark for gasoline engines is 20 to 15° ahead of "dead center." The rate of explosion of alcohol fuel is less than that of gasoline and, consequently, the spark should be set at 25 to 30° ahead of dead center; or a safe rule to follow would be to double the advance recommended by the makers for gasoline.

A lesson should be learned from Cuba's experience with motor alcohol.[12]

[12] Tillery, R. G., Louisiana Planter & Sugar Man. 67 (1921) 429.

Although the motor spirits industry cannot be said so far to be a complete failure in its competition with gasoline, certain facts with regard to the present consumption indicate that the demand is not increasing in the proportion that the producers had at first calculated upon. As a matter of fact, the consumption has apparently reached its peak, for the present at least, unless the manufacturers encourage it by producing a better product.

This situation has been brought about chiefly by the manufacturers themselves, through practices of their own rather than through any impossibility of a distiller's being able to produce an alcoholic motor-spirit which will compare favorably with the grade of gasoline now being sold on the Cuban markets. First of all, they attempted to sell the motor-spirits at a higher price than the relative value of the product in power development or mileage obtained as compared to gasoline indicated the motor-spirits to be worth. Second, they were instrumental in having a formula adopted by the Government which the present state of equipment of their plants could meet, and as a consequence, they are turning out a product which is inferior to all other motor-spirits which have been manufactured in other countries, and which have been determined by elaborate trials and experimental tests to compare favorably with the best grades of commercial gasoline. Third, they have not attempted to determine whether the engines in which comparative tests have been made in Cuba were properly adjusted for economic consumption of the motor-spirits and for efficient development of power, nor have they attempted to instruct the beginners in the proper manipulation of their engines during ordinary, every-day service, but rather have left it to the intelligence or ignorance of the chauffeurs to discover such matters for themselves.

The formula adopted by the Cuban Government was:

To 1,000 parts of alcohol of not less than 95%, add 0.5 part of formaldehyde, 8.00 parts of pyridine; and to every 100 parts of this mixture add 10 parts of gasoline or sulphuric ether, and 5 centigrams of methyl violet powder.

It will be noted that either gasoline or sulphuric ether may be used and, as not one of the distilleries was equipped to make ether, gasoline was used. To add almost 10 per cent of a product with which one is competing is not logical. Furthermore, a successful motor alcohol must have at least 40 per cent of a highly volatile liquid to compare favorably with gasoline. Cuba must either revise her formula and make a motor fuel containing at least 40 per cent of ether, or kill an industry which is capable of turning out 50,000,000 gallons of valuable motor spirits annually.

MANUFACTURE OF ALCOHOL-ETHER MOTOR FUEL

Alcohol distilleries now operating can easily make the alcohol-ether motor fuel by simply adding an inexpensive ether still and the requisite storage tanks to their present equipment. The ideal location for such a plant, however, is not in Manila but

at the sugar centrals or in connection with a nipa swamp, thus eliminating the high cost of transportation of the raw materials and fuel. In the former case the waste steam from the central can be utilized to run the distillery; in the latter, the mangrove wood can be utilized as fuel.

Cost of production.—An economical plant should have a daily capacity of at least 1,200 to 2,000 gallons of motor fuel. Smaller plants cost relatively more to erect and to operate.

A plant with a daily capacity of 1,200 gallons could be built in Hawaii in 1919 for $30,000, exclusive of buildings, boilers and fuel storage tanks. The cost of operation exclusive of molasses and steam will not exceed 10 cents (U. S. currency) and should not exceed 7 cents.[13]

A distillery of this size would require at least six fermentation tanks, with a total capacity of at least 100,000 gallons; four yeast tanks, with a total capacity of 15,000 to 20,000 gallons; a yeast-culture machine; an alcohol-rectifying still, 1,200 gallons daily capacity; two ether stills and scrubbers, 350 gallons daily capacity; and the necessary storage and mixing tanks. The capacity of the storage tanks would naturally depend upon shipping facilities, market, etc.

Another estimate [14] on cost figures, for an alcohol motor-fuel plant erected in the Philippines, is as follows:

Estimated cost of alcohol motor fuel plant producing 1,000 gallons per day.

	Dollars.
BOILER ROOM:	
1 75-horsepower steam boiler	1,572.00
Oil and water feed pumps, general fittings, etc.	2,000.00
FERMENTING ROOM:	
1 molasses scale	400.00
2 7,500-gallon mixing tanks	388.00
12 6,500-gallon fermenting tanks	2,164.00
3 2,000-gallon yeast tanks	212.00
3 250-gallon yeast tanks	58.75
2 pumps	400.00
STILL ROOM:	
1 modern copper continuous still, producing alcohol of 96–97 per cent in one operation	6,000.00
2 1,000-gallon charging tanks	115.00
1 1,000-gallon singlings tank	57.50
DENATURING WAREHOUSE:	
2 2,000-gallon metal receiving tanks	440.00
Denaturant storage tanks	250.00
1 500-gallon denaturing tank	100.00
1 air compressor	200.00

[13] Report of the Committee on Manufacture of Sugar and Utilization of By-products. Hawaiian Sugar Planters' Association (1920).

[14] Oscar Krenz Copper & Brass Works Inc., Sugar News 2 (1921) 591.

Estimated cost of alcohol motor fuel plant producing 1,000 gallons per day—Continued.

	Dollars.
ETHER ROOM:	
1 modern sulphuric ether generator	3,500.00
1 1,000-gallon supply tank	57.50
1 ether storage tank, metal, 1,000 gallons	144.00
FINISHED MOTOR FUEL STORAGE ROOM:	
2 5,000-gallon tanks	368.00
1 1,500-gallon mixing tank	58.00
1 pump	200.00
GENERAL:	
All piping throughout plant	2,000.00
Miscellaneous expense	1,815.25
BUILDINGS:	
Greatly varying as to type of construction, preparation of site, location, materials, etc., estimated at	12,500.00
Grand total	35,000.00

These figures are evolved from the result of practical experience in the erection and operation of numerous distilling plants and the particular experience of the erection of one motor fuel plant. The equipment figures and supply costs are based on current prices at San Francisco, California; plus freight charges delivered to Manila, P. I.

While the technical and engineering side of * * * [these] figures have been very carefully worked out allowance must be made in the items of labor, insurance, overhead, depreciation, etc. [see pp. 32 and 33]. Those items being governed by local conditions will vary somewhat. The figures used are reasonable and conservative. In the item of buildings also there can be some variance; however, the figure used is great enough to take care of the general type of buildings that would be called for in this kind of plant. Under favorable conditions this sum would be somewhat less, whereas under conditions where there would be much excavation or grading to be done, the estimated figure would be exceeded. No allowance has been made for ground site, it being assumed that such a plant would be erected on plantation premises so that this would not be an item of expense. The item of Molasses also is not charged for two reasons, first because molasses at the raw sugar mill is generally considered a practical waste, and second, because of the fertilizing value of the spent slop. This alone is generally conceded to be great enough to more than offset any reasonable costs for molasses. Inasmuch as an alcohol motor fuel plant would best be placed immediately contiguous to a raw sugar mill, there should not even be transportation costs in getting molasses into the motor fuel plant.

The ether can be made for less than 10 per cent over the cost of alcohol.[15] There are, however, two more-recent methods for manufacturing ether from alcohol which utilize the alcohol in the vapor phase. A purer product and higher yield are obtained at a lower cost than by the lead-still method.

[15] Humboldt, E., Power 50 (1919) 420.

The first method [16] consists of superheating the alcohol vapor to the right temperature, then passing it through a chamber containing lead balls over which sulphuric acid is allowed to drop slowly. Transformation to ether occurs instantaneously, the alcohol being in contact with the sulphuric acid only momentarily. The ether vapor is then passed through a washer containing caustic soda and then to a rectifying column to separate it from water and alcohol. About 3 pounds of acid and 14 pounds of soda are required for every 100 pounds (13.9 gallons) of ether made. This process is being used successfully in the Natalite factory at Merebank, Natal.

The second method is a catalytic process and eliminates the use of sulphuric acid and caustic soda. The alcohol is passed through a superheater and then over alumina. acting as a catalyst. The temperature of the vapor and catalyst must be kept constant at about 200° C. If the temperature rises above 200°, ethylene is formed. By passing the outgoing vapors through tubular heat exchangers to heat the incoming alcohol, a small superheater is the only necessary heating apparatus; the amount of heat necessary for the conversion is less than 10 per cent of that required in the lead-still process.

The estimated daily operating cost is given by Krenz [17] as follows:

Estimated daily operating cost of alcohol motor fuel plant producing 1,000 gallons per day.

	Dollars.	
19.34 tons average cane molasses	000.00	
No. 34 66 Be. sulphuric acid, 2.5c per lb.	.85	
No. 14 caustic soda, 5.4c per pound	.76	
21 gals. benzene, 50.0c per gal.	10.50	
10½ gals. pyridine, $1.86 per gal.	19.53	
40,000 gals. water, diluting, condensing, etc., pumping cost of 10c per 1,000 gals.	4.00	
6½ bbls. fuel oil, $7.28 per bbl.	47.32	
LABOR:		
1 fermenting room man and foreman, day shift	5.00	
2 distillers, night and day shifts, 3.00	6.00	
1 denaturer, day shift	3.00	
1 ether man, day shift	3.00	
2 firemen, day and night shifts, 3.00	6.00	
1 laborer	2.50	25.50

[16] Annaratone Process, French patent 408,089.

[17] Oscar Krenz Copper & Brass Works Inc., loc. cit.

Estimated daily operating cost of alcohol motor fuel plant producing 1,000 gallons per day—Continued.

	Dollars.
Interest at 8% on $35,000 over 312 working days, per day	8.97
Insurance on ⅓ plant value, premium 3.00 per 100 per year, per day	.11
Depreciation at 10% per year, $3,500; per day	11.21
Office expense, general overhead, etc., per day	10.00
Grand total	138.75

The above estimate shows that the cost of producing one gallon of alcohol from molasses, exclusively of the cost of molasses, is 13.87 cents (27.74 centavos). Mr. Foster computes the cost of operation to be 14 to 20 centavos, exclusive of molasses and steam. The fertilizer recovered from the lees practically covers the cost of the molasses. In the Philippines alcohol-ether motor fuel can undoubtedly be made to yield a handsome profit when sold at 50 to 70 centavos a gallon.

In Natal the original Natalite company showed a profit of 38 per cent in 1920. The original 5-pound shares of the parent company are now quoted at 105 pounds Sterling. When Natalite was placed on the market in Natal at 52 cents, gasoline was selling for 1.50 dollars. To-day there are several centers where gasoline is entirely off the market.[18]

In the Philippines, during the World War gasoline reached as high as 3 pesos a gallon. The present price is 1.15 pesos in Manila. At a price considerably lower than this, alcohol motor fuel can more than successfully compete with gasoline.

The present annual supply of molasses in the Philippines is a potential source of some 7,800,000 gallons of alcohol. The consumption of gasoline for 1920 was 9,160,000 gallons. Therefore, the Philippine Islands could almost supply its own needs for motor fuel by simply utilizing its present supply of molasses for such production. Since the nipa sap available is many times as great as the molasses supply, and is an even cheaper source of alcohol, the country is in a position not only to supply its own needs, but to export as well.

SUMMARY

The nipa palm and molasses offer cheap and easily manipulated sources of alcohol for use as a motor fuel.

[18] Wilson, Sugar News 2 (1921) 228.

Alcohol, alone, will probably not be used as a motor fuel until a new type of high-compression, slow-speed engine is developed.

Alcohol mixtures to-day are being used on a large scale in the present type of gasoline engine with simple alterations. These mixtures offer many advantages and no disadvantages over gasoline and are more efficient than gasoline.

Although no alcohol motor fuel is being manufactured at present in the Philippine Islands, two distilleries are installing the necessary apparatus for its manufacture. Utilization of waste molasses and of the unlimited supply of nipa sap in the production of alcohol motor fuel would not only make the Philippine Islands independent of other countries for its supply of motor fuel, but would also constitute a very valuable addition to the industries of the Islands. Since modern industry largely depends on an abundant and cheap supply of motor fuel and since in time of war the price of imported fuel goes skyward and the supply is curtailed, the establishment of an industry supplying motor fuel from the natural resources of the Archipelago will be of immense value to the Philippine Islands.

THE BURI PALM

The description and uses of the buri palm, *Corypha elata* Roxb., can be found fully discussed in another article.[27] The sap is used only to a small extent in the Islands at present and gives small promise of any large future development. In many places in the Philippines the inhabitants have every need supplied by this palm: bread from the pulp; sweetmeats from the young fruit kernels; houses from the leaves; hats, mats, ropes, and baskets from the leaf fibers; shoes from the bark; and sugar and wine from the sap.

In India, Australia, Malaysia, and other places various other species of palms yield saps which are utilized for making toddy and arrack, corresponding respectively to our tuba and vino. Among the palms thus utilized may be mentioned *Arenga saccharifera* Labill., the sugar palm; *Borassus flabellifer* Linn., the Palmyra palm; *Caryota urens* Linn., the fish-tail palm; *Phoenix dactylifera* Linn., the date palm; and *Phoenix sylvestris* Roxb., the wild date palm.

BIBLIOGRAPHY ON ALCOHOL MOTOR FUEL

ANON. Cassava as a source of industrial starch and alcohol. Bull. Imp. Inst. 17 (1919) 571.

ANON. Fuel for motor transport. Engineering 110 (1920) 120.

[27] Gibbs, H. D., Philip. Journ. Sci. § A 6 (1911) 167.

ANON. Motor fuel from waste molasses. Sugar 22 (1920) 335.
ANON. Data concerning the advantages, production, and cost of natalite motor fuel. Int. Sugar Journ. 23 (1921) 147, 213, 266, 386.
ANON. Fuel for motor transport. Second memo. by the Fuel Research Board. London (1921).
ANON. Production of 95–97% alcohol for motor fuel. Int. Sugar Journ. 23 (1921) 513.
APPELL, G. M. Alcohol production from molasses. Chem. Age (N. Y.) 29 (1921) 53.
BARNETT, E. B. Possible sources of home-produced motor spirit. Chem. Age (London) 3 (1920) 254.
BAUME, NICOLARDOT, et al. Physical-chemistry researches on liquid fuels. Chimie et Industrie 3 (1920) 761.
BLACK, J. Liquid fuel mixture. U. S. patent 1,360,872.
BOYD, T. A. Motor fuel from vegetation. Journ. Ind. & Eng. Chem. 13 (1921) 836.
BRILL, H. C., and THURLOW, L. W. Alcohol from discard molasses in the Philippine Islands. Philip. Journ. Sci. § A 12 (1917) 267.
CARSTEN, H. J. The utilization of waste molasses in the Philippine Islands. Philip. Journ. Sci. 17 (1920) 395.
CHEMICAL FUEL CO. OF AMERICA. Treating alcohol for making motor fuel. British patent 159,880 (1921).
COLE, H. I. Motor fuel from Philippine waste products. Trans-Pacific 6 (1922) 69.
COX, ALVIN J. Industrial alcohol and its possibility as a source of power in the Philippines. Philip. Journ. Sci. § A 4 (1909) 232.
DIXON, H. B. Alcohol as a motor fuel. Journ. Soc. Chem. Ind. 39 (1920) 355R.
DUMANOIS. The advisability of using liquid fuels. Bull. Soc. Encour. Ind. Nat. 132 (1920) 436.
FLINT, J., and BROWN, F. G. Liquid fuel. Canadian patent 209,167 (1921).
FOSTER, J. P. Industrial alcohol from molasses. Int. Sugar Journ. 21 (1919) 75.
IDEM. Motor alcohol, its theory and use. Sugar News 2 (1921) 521.
IDEM. Motor fuel. United States patent 1,384,946.
FREELAND, E. C., and HARVEY, W. S. Alcohol as a combustion fuel. Sugar 23 (1921) 536.
GJERDE, G. K. Motor fuel. Papier Journalen (1918) No. 6, 42.
GRIMWADE, W. R. Crops for the production of power alcohol. Bull. Commonwealth of Australia, Advisory Council of Science & Ind. 7 (1918).
HAYES, A. Blended motor-fuel. United States patent 1,378,858.
IDEM. Liquid fuels for motors. United States patents 1,361,153 and 1,363,870.
HAWAIIAN SUGAR PLANTERS' ASSOCIATION. Report of the committee on manufacture of sugar and utilization of by-products (1920).
HIBBERT, H. The role of the chemist in relation to the future supply of liquid fuel. Journ. Ind. & Eng. Chem. 13 (1921) 841.
HUMBOLDT, E. The possibilities of new fuel mixtures for internal combustion engines. Power 50 (1919) 418.
LIGHTFOOT. Power alcohol. Bull. Australian Inst. Sci. Ind. 20 (1921).
LUCKE, C. E., and WOODWARD, S. M. Farm. Bull. U. S. Dept. Agr. 277 (1907).

IDEM. Test on internal combustion engines on motor fuels. Bull. P. S. Dept. Agr. Office of Exp. Sta. 191 (1907). Also Engineering News 59 (1908) 271.

LYLE, T. R., et al. Power alcohol, proposals for its utilization in Australia. Bull. Advisory Council of Science & Ind. 6 (1918) Melbourne.

MAGNÉ. Pamphlet on The manufacture of alcohol from molasses and cane juice. New Orleans, La., U. S. A.

MAILHE, A., and GODON, F. Catalytic preparation of ordinary ether in a dry manner. Bull. Soc. Chim. IV 25 (1919) 565; 27 (1920) 121.

MARKS, E. C. R. Motor spirit. British patents 147,398 (1919); 153,925 (1919); 154,867 (1919).

NATALITE. British patents 24,262 (1914); 17,017 (1915); 375,453 (1916); 378,700 (1917).

NORTHROP, J. H. Acetone and alcohol by fermentation with B. aceto-ethylicum. United States patent 1,293,172.

ORMANDY, W. R. Criticisms of patents on motor fuels containing alcohol. Int. Sugar Journ. 22 (1920) 402.

IDEM. The motor fuel problem. Journ. Inst. Petroleum Tech. 5 (1918) 33.

PURGOTTI, A. Employment of alcohol in explosion motors. "Ethnol." Giorn. chem. ind. applicata 2 (1920) 191.

REDWOOD, BOVERTON, et al. The production of alcohol for power. Chem. Age (London) 1 (1919) 66.

SCARD, F. I. Power alcohol in the United Kingdom. Int. Sugar. Journ. 23 (1921) 434.

SCARRATT, A. W. The carburetion of alcohol. Journ. Soc. Autom. Eng. 8 (1921) 328.

SESTI, C. G. Motor spirit. British patent 147,803 (1920).

SHAVE, G. J. Benzene-alcohol experiments on omnibuses. Engineering 110 (1920) 623.

STEVENS, E. W. Distilling alcohol for use in motor fuels. United States patent 1,372,465.

STEVENS, E. W. Motor fuel. United States patent 1,388,531.

STRONG, R. M. Commercial deductions from comparison of gasoline and alcohol tests on internal combustion engines. Bull. U. S. Geol. Survey 392 (1909).

STRONG, R. M., and STONE, L. Comparative fuel values of gasoline and denatured alcohol in internal combustion engines. Bull. Bur. Mines 43 (1920).

TILLERY, R. G. Use of alcohol made from final molasses as motor power in Cuba. Louisiana Planter 56 (1921) 142.

IDEM. The alcoholic motor-spirits situation in Cuba. Louisiana Planter 67 (1921) 429.

TUNISON, B. R. Molasses best source of industrial fuel. Sugar 22 (1920) 397.

IDEM. The future of industrial alcohol. Chem. & Met. Eng. 21 (1919) 557.

IDEM. The future of industrial alcohols. Journ. Ind. & Eng. Chem. 12 (1920) 370.

WALLIN, H. Swedish motor fuel. Svensk Pappers Tid. 24 (1921) 69.

SUPPLEMENT

Supplementary to this paper is given a résumé of articles published by the Bureau of Science on the utilization of palm

saps as a source of alcohol; most of these publication are out of print.

THE NIPA PALM, NIPA FRUCTICANS WURMB

The nipa [19] is an erect, stemless palm, the leaves and inflorescences arising from a branched rootstock, the leaves pinnate, 3 to 10 meters long. Inflorescence from near the base of the leaves, erect, brown, 1 to 1.5 or 2 meters high, bearing numerous sheathing spathes and both male and female flowers, the former lateral, catkin-like, the latter terminal in a globose head. Fruit nodding, globose, as large as a man's head or often considerably larger, consisting of many obovoid, 6-angled, 1-celled, 1-seeded carpels, the free parts pyramidal, the pericarp fibrous, the seed large, white, hard.

This species of palm grows in great abundance throughout the Archipelago in the tidewater estuaries and tidal rivers or other places flooded by the tides with brackish water. It does not thrive in either fresh- or salt-water marshes. Plate 1 shows the distribution of nipa swamps in the Islands.

* * * Rated in order of size, irrespective of their present commercial importance, the most extensive areas are situated as follows:

Portions of the provinces of Pampanga and Bulacan bordering on Manila Bay, Island of Luzon. Province of Capiz, Island of Panay. The valley of the Cagayan River, Island of Panay. The valley of the Cagayan River, Island of Luzon. The valleys of the Catubig and the Gandara Rivers in the Island of Samar. The Province of Pangasinan, Island of Luzon. Surigao, Island of Mindanao. The Province of Tayabas, Island of Luzon.

The other nipa areas of the Philippines do not compare in size with those listed above.

In this connection it might be well to point out that the tidewater flats on which the nipa flourishes also produce various species of mangrove. The mangrove furnishes a valuable source of fuel which in virgin stands could be utilized for the distillation of the nipa sap. The virgin mangle has long since disappeared from the region around the upper part of Manila Bay. In this district cultivated mangrove swamps are found from Malabon on the east to Balanga on the west side.

Nipa [20] and bakauan [a species of mangrove most used for firewood] are planted extensively in solid stands, but there is little planting of other swamp species.

Hundreds, and may be thousands, of hectares are planted to bakauan, which is grown for firewood, and sold principally in the Manila market, this wood being preferred to almost all others for fuel. The Manila supply is inadequate, as is indicated by the remarkably complete utilization of the swamps in the vicinity, and by the use of other and inferior species.

[19] Gibbs, H. D., Philip. Journ. Sci. § A 6 (1911) 99–206. Since reprints of this article are exhausted, part of it will be quoted in full, other parts abstracted and brought up to date.

[20] Brown, W. H., and Fischer, A. F., Philippine Mangrove Swamps, Bull. P. I. Bur. Forestry 17 (1918) 94.

No records seem to exist as to how, when, and where bakauan was first cultivated, but it is safe to say that the present planting methods have been in use for at least three generations. An evident reason for the cultivation is the large agricultural population on the level lands of Pampanga Province and the accessibility of the Manila market.

In the municipalities of Macabebe, Guagua, Lubao, Sexmoan, and Orani there are a number of barrios along the rivers which have a population that divides its labor among the fishing, bakauan, and nipa industries.

Table 3 shows us that the nipa juice is the cheapest source of alcohol available. It is also cheaper to produce alcohol from nipa than from grains or even from molasses, as it is not necessary to dilute the sap with water or even to seed it with yeast. Not only do the palm saps ferment readily, due to the wild yeast always present, but they ferment very rapidly so that the fermentation is often complete in less than twenty hours. The elimination of pure water necessary for dilution, pure yeast for seeding, addition of chemicals, and the shortening of the fermentation period all mean considerable saving in the production of the alcohol.

There are at present only a few nipa districts utilized for the collection of nipa tuba as a source of alcohol. Most of these are in the nipa area on Luzon in Bulacan and Pampanga Provinces. This district extends along Manila Bay for about 32 kilometers with an average width of 5 kilometers. A considerable portion of it is controlled by various large distilleries. Only about 30 per cent of the total area of the district is at present utilized. Some of the nipa areas near Manila have been converted into fish ponds which seem to yield a greater income per hectare than does nipa at present.

LABOR CONDITIONS IN THE NIPA SWAMPS

The best managed *nipales*, or nipa groves, are divided into sections of about 1 hectare, containing from 700 to 800 producing plants in every hectare, each of which is assigned to the care of one or more men. Usually two men are required to handle 1 hectare and the work of cutting the plants, gathering and transporting the *tuba* to the distillery and the general care of the grove is divided between them. Since the sap not only has a recognized commercial value at the distillery, but is also greatly prized by the natives as a beverage, a close watch by the guards is necesssary.

The sap, as it drops from the flower stalks, is collected in hollow joints of bamboo. Each plant is visited daily and the sap brought to the distillery in *bancas* of light draught which the natives paddle in and out of the waterways. Sometimes the *tuba* is emptied into large earthenware jars and these are transported to the distillery, and, again, it is emptied directly into the boat. A nipa leaf is cut and placed in the banca over the *tuba* to prevent undue slopping, and thus, more or less immersed in the partially fermented *tuba*, the boatmen make the trip. The time for gathering the sap is in some measure dependent upon the tides, for many of the small

waterways are navigable only with difficulty or else are impassable at low tide, even for such a light draught vessel as the native canoe. The collection in some localities begins at 1 o'clock in the morning and is completed within 6 hours.

The laborer in the nipa groves builds himself a house of nipa leaf thatch with bamboo framework, on the bank of a stream on the nipa estate. Fish, the principal article of food, are easily caught in these places. Here, usually with a large family, he lives in peace and contentment.

The communities in these nipa areas are old-established ones, and undoubtedly attempts to establish new communities to-day for work in the swamps would be a difficult matter. More inducements would have to be offered than were offered in the past; medical attention, stores, and amusements would have to be included, barrios constructed, and a water supply provided in order to obtain the laborers and keep them contented.

PROPAGATION OF THE PALM

The nipa palm reproduces from seed and also by the branching of its roots. The original seed produces two plants, each of which in turn produces two more at the growing points formed by the branching of their roots, and so on. Hence the life of a nipa swamp is indefinite. It is said that care must be taken not to bleed both of two root-connected plants at the same time as in that case the plants will die. When the palms are raised from seed, the planting is done just before the *tuberos* begin the first harvest. The seeds are put in about 2 meters apart, making 100 seeds per *loang* (about 0.04 hectare). The plants begin to bear in about five years. By that time each plant has four growing points, about 1 meter distant from each other.

HARVESTING OF THE NIPA SAP

Conrado and Zobel [21] enumerate the following operations that are connected with the collection of the sap:

The *hauan*, or "clearing up."
The *sicat*, or "kicking the stem."
The *talog*, or "cleaning the stem."
The *pucao*, or "working of stem to make it soft and limber."
The *patit*, or "cutting of the stem."
The *cortes*, or "daily sectioning of the stem."

The "clearing up" is usually done in July or August. The nipales are parceled to the tuberos who are required to clear

[21] Conrado, A., and Zobel, E., Estudio de la planta llamada "nipa" de su cultivo y de sus propiedades. Imp. y lit. de "La Concepción," Marques de Comillas No. 3, Manila (1906).

them of underbrush, dead leaves, etc. Since the nipa sends its inflorescence up from the base and hence is near the ground, the flower stalk is conveniently situated for tapping and for gathering of the sap. The nipa bears small fruits in its fourth year but is not usually tapped until its fifth year. The stalks of the chosen fruits (nearly full-grown ones) are stripped of leaves and are kicked at the base about five times at intervals of about a week, several kicks being given each time. This is to start the flow of tuba. The stalk is then cut across near its top, usually just below the fruit, and each day a thin slice is removed to keep the wound fresh and to facilitate exudation. When a plant bears two flower stalks the usual practice is to draw sap from only one, the other being removed and the stem allowed to dry.

The sap is collected in bamboo joints, called *tuquils* (Pampangan), or *bombones* (Spanish), which are hung upon the stem. The receptacles are about 45 centimeters high and 8 centimeters in diameter and have a capacity of about 2 liters.

One stalk normally flows for about three months, but it is not uncommon for it to be entirely cut away, at least so close to the ground that it can no longer be utilized by the daily paring of small slices, long before the flow has ceased. In some districts the flower is cut before the fruit is formed, and under such circumstances the daily yield of sap is said to be increased but the period of flow reduced from three to one and one-half months, the total yield being practically the same in both cases. The plant seemingly is not affected by this treatment. A recent report by Dr. G. A. Perkins [22] gives the following data on harvesting of the sap:

> The *tuberos* are alloted bamboo from which to make *tuquils* and also are alloted bancas, in which they transport the *tuba*. These bancas are mostly hired by the company at 3 to 8 pesos per month (now about 6 pesos). About 120 tuberos are required for the first harvest (2,000 hectares). Each man handles about 1,000 producing palms. The harvest begins in July when the fruits are cut, but most fruits are reserved until the end of the floods (about August 20). The harvest ends about December 20, not all fruits being cut at the same time. Each fruit stalk flows about two and one-half months.
>
> The second harvest is from December 20 to April 10 requiring 80 tuberos who work about 800 plants each. The tuquils surviving the first harvest are used. No fruits are usually cut from April 10 to the last of June, but for the sake of having yeast for fermenting molasses a third, or "extra," harvest is often taken by reserving fruits which could be cut in the second harvest. In 1920, 44 tuberos were employed on one

[22] An unpublished report.

estate in the third harvest, each tubero handling about 500 stalks. The tuberos receive 7 centavos per *tinaja* (36 liters). This includes all work in preparation for harvest, but bancas and bamboos are supplied to the tubero.

The only known disease of the nipa plant is *absic,* which is caused by insect attack on the leaves. Rain kills practically all the insects, but sometimes it is necessary to cut the infected leaves.

The number of plants per hectare.—The number of plants per hectare varies within wide limits depending upon whether the swamps are cared for or overgrown, the former condition naturally giving superior plants. A conservative estimate for cultivated nipales, or nipa swamps, can be placed at 2,000 to 2,500 palms per hectare, of which 750 can be depended upon to produce fruiting stalks. Intelligent care and selection of seed undoubtedly would raise the yield of sap and the percentage of sugar in the sap.

Yield of sap.[25]—The estimates of the yield of sap vary within very wide limits. A distiller who has had much experience in the *nipales* believes that each producing plant will average 1.25 liters daily, and a chemist at one time employed by one of the distillers has stated that an average plant will flow 50 liters during the season.

The yield per hectare has been estimated by many different writers and distillers and it is evident from a perusal of the figures that many are mere guesses. The number of plants per hectare is estimated by a chemist in the employ of one of the distillers to be 2,500. Internal Revenue Agent G. A. Ruge believes the municipalities of Abulug and Pamplona in the Province of Cagayan to have *nipales* containing 4,600 plants per hectare. A distiller of wide experience told me that the number is 700. If this latter figure is taken to be 700 plants producing at the same time I have no doubt that it is fairly accurate for the areas controlled by his company. He also stated that they obtained in actual practice 438 liters per hectare daily during the season. This is equivalent to 78,480 liters yearly per hectare, a figure quite close to my estimates. Other figures, not so reliable, go as high as 225,000 liters per hectare.

It is to be remembered that while wild nipa swamps may contain 4,000 plants per hectare, the percentage of producing plants and the amount of sap which each plant yields will be less than in the cultivated districts. In the uncultivated areas a small proportion of the trees is accessible; in the cultivated, the plants are thinned, and there are more waterways, and yet the yield of sap per hectare is greatly increased. A yield of 75,000 liters of tuba per hectare per year would be extremely satisfactory to the distillers, and I believe this amount is seldom reached in the best managed *nipales.* It should, however, be exceeded. Some operators obtain only 4,000 liters per hectare during a full season.

In the year 1909 one of the largest producers obtained 8,700,000 liters of tuba from an estimated area of 1,000 hectares which is at the rate of

[25] Gibbs, H. D., op. cit. 117.

8,700 liters per hectare. Less than one-third of this area was producing, partly from lack of labor and partly because the greater portion of the estate had not been made accessible to the distillery. The alcohol production from this yield was about 5 per cent.

The atmospheric and climatic conditions affect the flow of sap. The natives working among the plants are positive that they can predict the approach of a storm by a sudden checking, in some cases amounting to almost a stoppage, in the flow, occurring about three days before the arrival of the typhoon. It is stated that after a temporary stoppage has been produced by meteorologic conditions an increased flow will start which will balance the period of inactivity.

The seasonal variation in the composition of the fresh tuba must be slight, although when received at the distilleries the differences, both in quality and quantity, are very great. This is undoubtedly due to the fact that rains dilute the juice after it has flowed from the flower or fruit stalk. The gain in volume is balanced by the loss in sugar and alcoholic content.

As a result of experimental work performed by Gibbs and others, an estimate of the yield of sap per plant per season is given as 43 liters, in a nipale cared for under average conditions according to present methods. This means an average daily yield of 0.58 liter and a total yield of 87,000 liters per hectare per year. The average flow of sap during the season is well shown in fig. 2.

The following data were obtained by Gibbs [24] on six trees:

	Liters.
Total flow from six trees	260.286
Greatest total flow from a single tree	49.410
Lowest total flow from a single tree	36.335
Average seasonal flow per tree	43.381
Average daily flow from six trees	3.470
Greatest daily flow from one tree	1.770
Average daily flow per tree	0.579

The composition of the sap.—From analyses made by Mr. Francisco Agcaoili, of the Bureau of Science, the following is the composition of a good quality sap:

Brix	17.0
Density $\frac{15°}{15°}$	1.020
Total solids	18.00
Ash	0.48
Acidity	Trace.
Sucrose	17.00
Reducing sugar	Trace.

An invertase proferment, or zymogen, also occurs in the sap.

Changes in the composition of the sap.—The inversion of the

[24] Op. cit. 121.

sucrose and the alcoholic, acetic, and other fermentations begins almost immediately after the sap drops from the stem into the tuquil under ordinary local conditions of collection. When the sap arrives at the distillery the inversion is complete and the alcoholic fermentation has begun and is sometimes completed. The juice is now milky in appearance and covered by a thick layer of foam. When the sap is collected in clean vessels the inversion does not begin for four or five hours. A white flocculent precipitate is slowly formed. The inversion of the

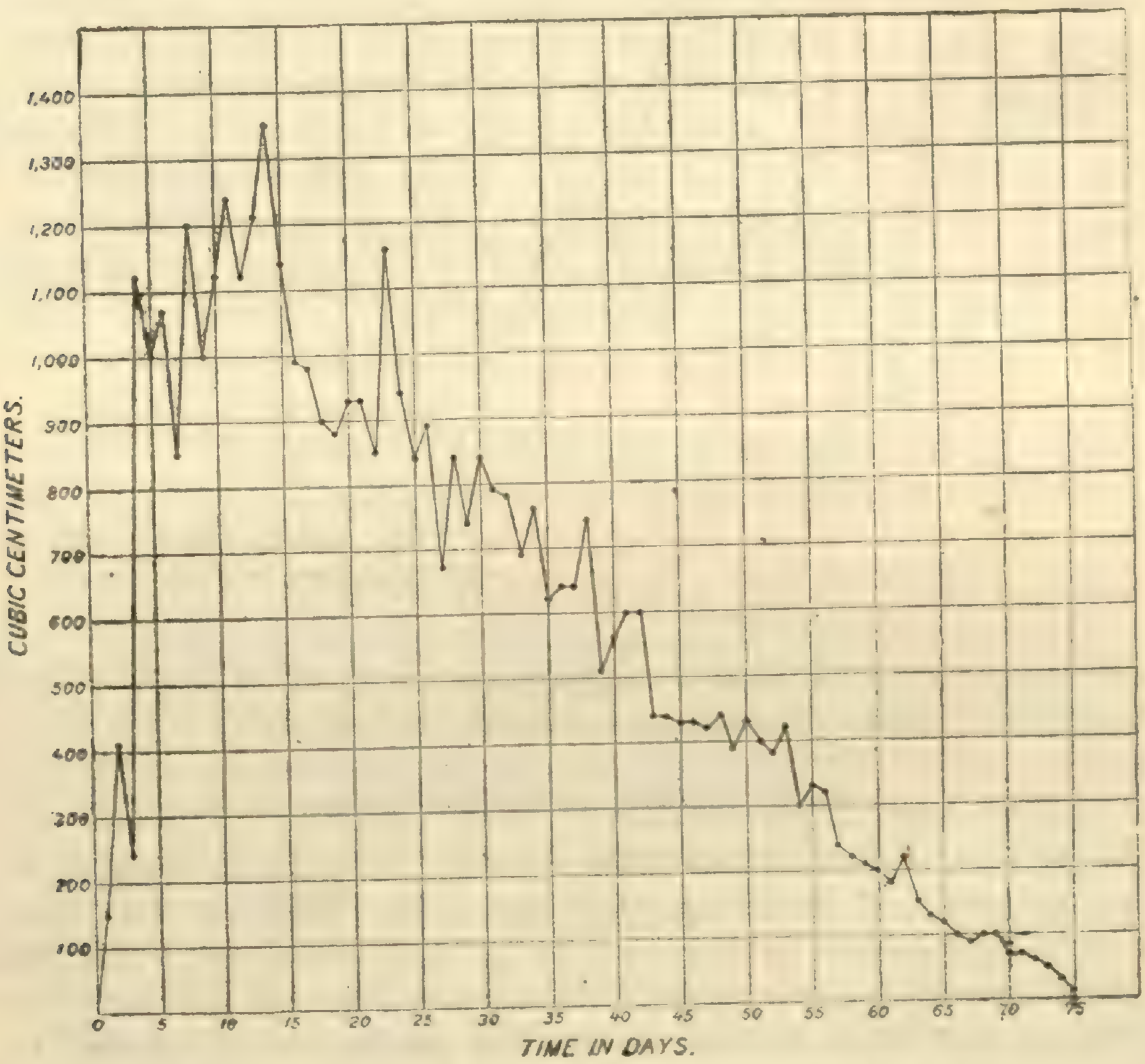

FIG. 2. Sap flow of nipa palm, average of six trees during one season.

sugar begins at the same time. Gibbs has shown that a zymogen present in solution in the sap causes the separation of a white flocculent invertase which rapidly attacks the sucrose present. He found that if clean tuquils are used and limed with thick lime cream, the sap collected in them will remain unchanged for more than ten days.

The rate of inversion of the sugar and the rate of formation of alcohol and acid are well brought out in fig. 3.

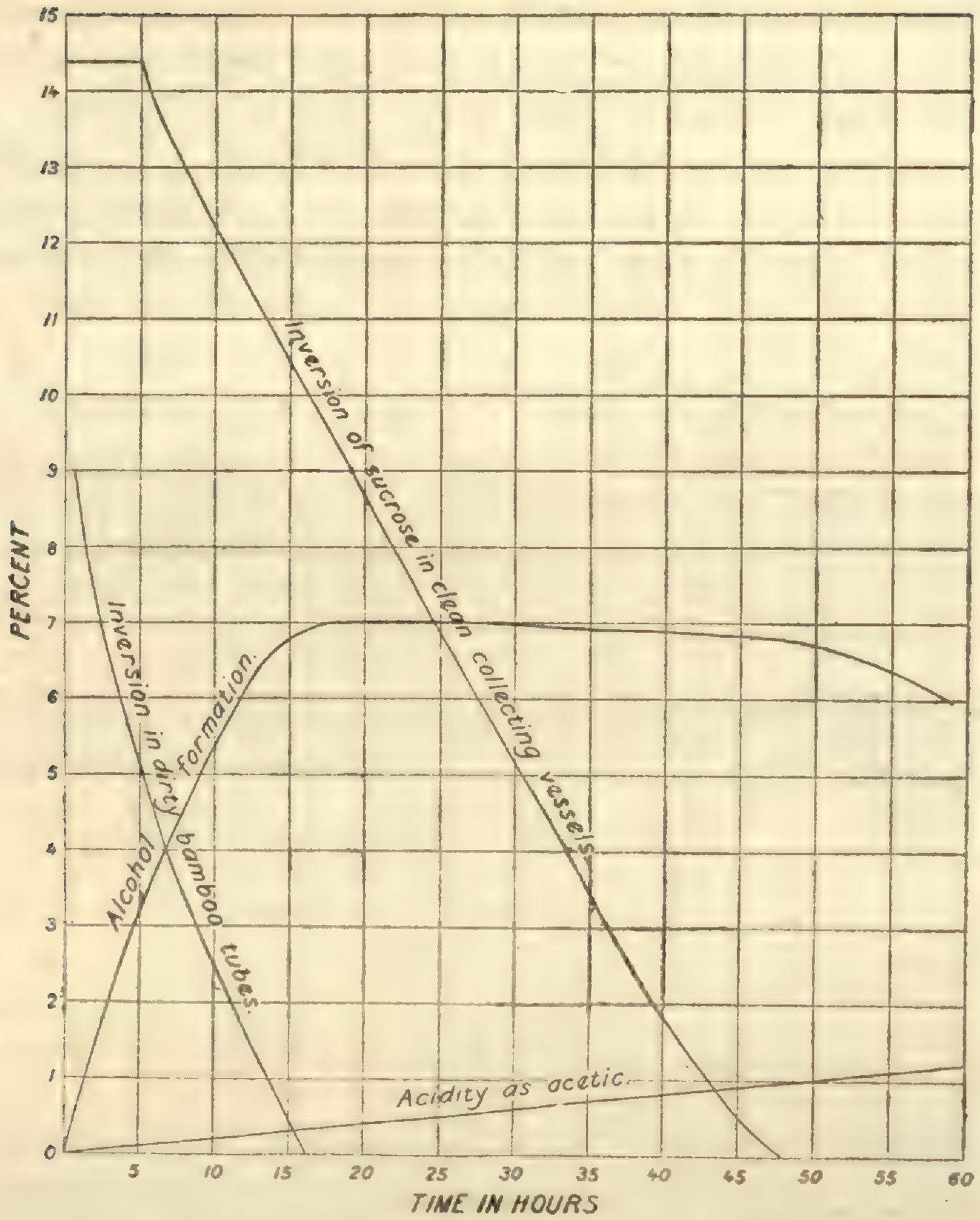

FIG. 3. Spontaneous fermentation of the nipa palm sap.

DISTILLERIES FOR NIPA TUBA

Twelve provinces from time to time have been engaged in the industry of distilling nipa sap. The tendency has been toward a decrease in the number of distilleries operating, the primitive and inefficient distilleries being crowded out by more-modern and more-efficient plants, the production of alcohol increasing to some extent. In the nipa district bordering Manila Bay all the distilleries use continuous rectifying stills, producing either 100° to 120° proof alcohol or high-grade alcohol of 180° to 190° proof.

Fermentation.—The nipa tuba as received by the distilleries is already partly or wholly fermented. It contains, besides the desirable wild yeast, many undesirable organisms. The tuba is placed in wooden or concrete fermentation tanks and allowed to ferment. The fermentation is usually allowed to proceed until the foam subsides or the temperature of the ferment falls.

The time allowed for fermentation varies from thirty hours to three days. It has been shown that even thirty hours is too long, much of the alcohol being changed into acetic acid by that time. Most of the large distilleries now ferment a mixture of molasses and nipa, the latter usually containing enough invertase and wild yeast to change the sugar in the molasses rapidly to alcohol. Molasses thus becomes a cheap source of alcohol and the distillery is often able to operate during the entire year, even during the season of small sap production. At certain seasons of the year, however, the nipa sap seems to have a detrimental effect on the production of alcohol from molasses, only 1 or 2 per cent of alcohol being obtained. This is due to the killing of the yeast by the acid bacteria. In some distilleries no attempt is made to check fermentation at the highest alcohol content. This means that, while the wash is stored before going to the still, a loss of alcohol occurs due to acid fermentation. In some cases, the high acidity of the beer is neutralized by lime made on the spot by burning oyster and other shells. Fermentation can be checked at the proper moment by the addition of an excess of lime to the wash, and then the latter can be stored without appreciable change to await its turn to be run to the stills.

Distillation.—Distillation is usually accomplished in either pot stills or continuous rectifying stills, the former usually heated directly by wood or wood and coal fires, the latter by steam coils. The first distillate from the pot stills is collected until it has the requisite percentage of alcohol (20 to 50) desired for beverage purposes. The distillation is further continued until most of the alcohol has passed over. The pot is then emptied and the second fraction poured back to form part of the next run.

The continuous stills give alcohol up to 100° proof. The rectifying stills yield an alcohol as high as 190° proof. The losses that occur are largely in the waste which contains sometimes as high as 1 per cent of alcohol.

THE COCONUT PALM

The cultivation of the coconut palm and methods of obtaining the sap from it are fully described by Gibbs.[25] Large numbers or palms are utilized exclusively for their sap, which is made into the native drink *vino de coco*. This is a misnomer, for

[25] Op. cit. 147.

vino de coco is not a wine, but a distilled liquor containing from 20 to 50 per cent of alcohol.

There is more labor involved in obtaining the sap from the coconut palm than from the nipa because of the height of the trees. To facilitate the collection bamboo poles are usually attached from tree top to tree top, forming bridges upon which the collector can travel from tree to tree without descending to the ground until his receptacle is full. Since the coconut blossoms throughout the year the tuba season is continuous, and when one stalk is exhausted another is tapped. Usually not more than two stalks on a tree are tapped at the same time.

The yield of sap.—The flow of sap varies with the age of the flower stalk, age and condition of the tree, character of the soil, and climatic conditions. The rate of flow is less during the heat of the day than at night. A tree will grow about ten stalks annually, and each will run sap for about two months. A tree is in its prime when about 40 years old. An investigation of seven distilleries in Tayabas Province revealed the fact that the average daily production from 5,785 trees from April, 1909, to March, 1910, inclusive, was 0.65 liter per tree.[26]

Gibbs found, however, that trees when properly handled by a sufficient number of men would yield approximately 1.4 liters per tree daily.

Composition of the sap.—Fresh sap in which no chemical change has occurred, taken from an average tree in its prime, will probably have about the following composition:

	Grams in 100 cc.
Density	1.0700
Total solids	17.5
Acidity	Trace.
Ash	0.40
Sucrose	16.5
Invert sugar	Trace.
Undetermined nitrogenous compounds, etc.	0.60

[26] Op. cit. 154.

ILLUSTRATIONS

PLATE 1

Map of the Philippine Islands, showing distribution of nipa swamps.

TEXT FIGURES

FIG. 1. Percentage loss of ammonia from Natalite fuel.
2. Sap flow of nipa palm, average of six trees during one season.
3. Spontaneous fermentation of the nipa palm sap.

PLATE 1. THE PHILIPPINE ISLANDS, SHOWING THE DISTRIBUTION OF NIPA SWAMPS.

THE USE OF SULPHUR FUMES IN COPRA DRYING [1]

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and

G. A. PERKINS

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TWO PLATES

A few years ago almost any grade of copra or coconut oil was salable at a good price. To-day a "Manila" oil of high rancidity and color finds a poor reception in the markets of the world. The Philippine oil mills are faced on one hand with a demand for high-grade oil, and on the other with a low-grade supply of copra from which good oil cannot possibly be made except at a prohibitive cost. This situation is thought by many to require the "cure-all" of legislation, but the writers favor the use of other methods to improve the quality of Philippine copra. The application of sound business principles to the oil and copra industries would solve the difficulty.

The main cause of color and free fatty acid in coconut oil is the action of mold on the copra. Any method, therefore, of drying coconut meat that protects it from mold and contamination with dirt and smoke makes possible the production of good oil. The most economical method of drying for very large plantations, and at the same time one which produces excellent copra, is by steam, using modern machinery. The economy of this method is that it saves labor, which is a very important item on large holdings. On smaller plantations, such as are found generally throughout the Philippines, the initial cost and overhead expenses of steam dryers are large items compared with the labor that they save.

The problem of how to dry copra on large plantations has been rather satisfactorily handled by the firms that manufacture drying machines, some of which have agencies in Manila. Therefore, the problem of the small plantation has occupied the

[1] Received for publication January 28, 1922.

attention of the Bureau of Science, and the use of sulphur has been found well suited to this field.

The process of sulphuring copra has been described and its advantages have been pointed out by Brill, Parker, and Yates.[2] The purpose of the present paper is to record certain modifications that have been found advisable during several years of successful commercial use of the process in the Philippines.

THE SULPHURING BOX

One form of sulphuring apparatus is shown in Plate 1, fig. 1. A slightly different type is shown in Plate 1, fig. 2, and Plate 2, fig. 3. The details of construction of this apparatus, which was made by Mr. H. J. Detrick, at Polo Plantation, Dumaguete, are as follows:

The sulphuring box, inside measurements 120 centimeters (4 feet) wide, 265 centimeters (8 feet, 10 inches) long, 210 centimeters (7 feet) high, was constructed of tongue-and-groove lumbayao, 2.5 centimeters (1 inch) thick. Eight uprights 5 by 10 centimeters (2 by 4 inches) were employed. It was erected in a shed with galvanized iron roof and dirt floor.

One length, about 5 meters (17 feet), of 60-centimeter (24-inch) cane track, and two pairs of wheels, with rough boxings, were purchased from a sugar hacienda at Bais. A frame of 5-by-10-centimeter (2-by-4-inch) and 5-by-15-centimeter (2-by-6-inch) pieces was fitted over the wheels. The track was laid in a ditch 20 centimeters (8 inches) deep.

Sixteen trays, outside measurements 90 by 230 by 10 centimeters (3 feet by 7 feet 8 inches by 4 inches), were constructed of malatabigi about 3 centimeters ($1\frac{1}{8}$ inches) thick. The bottoms were made of bamboo strips about 6 centimeters (2.5 inches) wide, leaving a maximum opening of 1.3 centimeters (0.5 inch). This floor rested at the ends and at three places between the ends on horizontally laid 5-centimeter (2-inch) strips. The whole was strengthened by nailing above the bamboo directly over each of the crosspieces, except the central one, a strip of 6-by-3-centimeter ($2\frac{1}{2}$-by-$1\frac{1}{8}$-inch) malatabigi. This construction produced strong ends made up of three pieces, one 10 centimeters (4 inches), one 6 centimeters (2.5 inches), and one 5 centimeters (2 inches). The 6-centimeter (2.5-inch) pieces were laid upright, like floor joists (see Plate 2, fig. 3).

The capacity of this box was 3,000 nuts (without shells).

[2] Brill, H. C., Parker, H. O., and Yates, H. S., Copra and coconut oil, Philip. Journ. Sci. § A 12 (1917) 80.

Cost of constructing the sulphuring box.

	Pesos.
Wheels and track, second hand	20.00
2-by-4-inch lumber, 80 feet at 0.125 peso	10.00
Tongue-and-groove lumbayao, 252 feet at 0.16 peso	40.32
1½-inch malatabigi, 260 feet at 0.148 peso	38.48
Bamboos, 25 at 0.15 peso	3.75
Nails, 7 kilograms at 0.70 peso	4.90
Labor	14.40
Transportation, approximate	20.00
Total	151.85

Sulphur burner.—The sulphur is burned in a pan placed on the dirt floor of the box. To utilize crude native sulphur a flat pan, made from a kerosene can, was devised by Mr. Detrick. The top and the bottom were removed, and the sides flattened out in one piece. The edges were then bent up to form a tray 22 by 75 centimeters.

The amount of sulphur to be used depends on the rainfall and conditions of drying. One kilogram for each charge is usually sufficient, and requires about four hours in burning. Pure sulphur is sold in Manila drug stores for 0.30 peso per kilogram, but the crude variety found in Silay, Occidental Negros; Biliran, Leyte; Camiguin, Misamis; Camiguin, Cagayan; and other parts of the Philippines is also suitable for this use.

PREPARATION OF THE NUTS

The nuts can be sulphured before removal of the shells, but it is better to sun them, if possible, for an hour or so after opening (see Plate 2, fig. 4); then the meat is separated from the shell with a copra knife, and placed on the sulphuring trays. The preliminary sunning shortens the work by loosening the meat. In case the trays are made with solid sides and placed directly on each other with no air space between they are staggered, as shown in Plate 1, fig. 1, in order to allow circulation of the sulphur fumes. Loading the high pile of trays on the truck is facilitated by digging a shallow ditch for the track, as shown in this photograph.

The loaded truck is rolled into the box, a match applied to the sulphur, and the door closed tightly. If 1 kilogram of sulphur is used, six hours in the box is sufficient for the full effect of the fumes. Larger charges necessitate somewhat more time, or the entrance of a little air at the bottom may be permitted, to burn the sulphur more rapidly.

DRYING

The use of sulphur has been expected by some to dry the copra. This is not the case, but sulphured coconut meat can be dried in a shed without sunshine, if necessary. Plate 2, fig. 2, shows sundried copra which had been placed in the bodega several times on account of rain. One *amacan* in the left foreground shows plainly the ravages of mold under those conditions on copra which has not been sulphured. The clean white copra on the other amacans in the foreground was treated in exactly the same way except that it was sulphured soon after opening. One and one-half kilograms of sulphur per charge of 2,500 nuts has been used in this case.

In regions where the rainy season is severe, drying sheds can be constructed in which trays of copra can be stacked with air space above every tray for ventilation. In such a shed sulphured copra can be dried in two or three weeks without sunshine. In regions where the rain is less severe the expense of shed construction can be avoided by sundrying on a floor, amacans, or trays. At Polo Plantation it has been found most satisfactory to spread the coconut meat thinly on light trays, which are easily stacked and covered with a small nipa roof at night or in case of rain (see Plate 2, fig. 1). The time required for drying is four days or more, depending on the weather.

NATURE OF THE PRODUCT

Sulphured copra, properly dried, has a lighter appearance than the whitest sundried copra, because the sulphur partially bleaches the dark outer skin of the meat as well as preserves the natural whiteness of the inside surface. The moisture content is about 5 per cent, and the free fatty acid less than 1 per cent.

The sulphur dioxide partly evaporates from the copra during drying, and partly oxidizes to sulphuric acid. The sulphuric acid formed does not remain in the oil, or injure it in any way, It does remain in the press cake, however. For this reason, and because there is sometimes difficulty in expressing all of the oil from very highly sulphured copra, it is better to sulphur lightly when possible. It has been found that when about a kilogram of sulphur per 3,000 nuts is used, on an average, the protection against mold is ample and no trouble is met with in expressing the oil or in using the cake for animal feed. The cake produced is, in fact, superior to the ordinary grade of cake made from rancid, moldy copra.

The direct protection afforded by sulphur dioxide does not last more than a month, but it is well known that copra is not susceptible to mold if once thoroughly dried and kept in a reasonably dry place. Copra beetles, unless checked, will eventually attack any copra and rapidly destroy copra that has become moldy. They are not attracted, however, by sound copra, so that the prevention of mold by sulphuring also prevents spoilage by beetles, for a number of months, at least.

WHEN TO USE SULPHUR

Sulphuring should be done soon after the nuts are opened, if rainy weather is anticipated. If unsulphured copra is rained on unexpectedly, it can be sulphured even after mold has started. The mold, or insects, can always be killed, and immediate further damage prevented, but it is advantageous to sulphur as soon as possible to prevent damage and loss of oil.

Sulphuring is valuable chiefly as an adjunct to the sundrying process. It is not necessary if a rapidly acting hot-air dryer is used, but can be employed to supplement hot-air drying in homemade kilns. It is also of value to the copra trader, who is often obliged to redry low-grade copra, and to kill the insects and the mold that otherwise soon complete its destruction.

ILLUSTRATIONS

Plate 1

Fig. 1. Sulphuring box with sixteen trays, containing the meat from about 3,000 nuts.

2. Sulphuring box with nine trays. These nuts (1,200) are to be sulphured before removing the shells.

Plate 2

Fig. 1. Stacks of sulphured copra ready for rain. Courtesy of Mr. Detrick.

2. Copra, sulphured and not sulphured. The amacan in the left foreground shows the best grade of copra that could be produced at that time without the use of sulphur.

3. Suphuring trays. The drying trays are made lighter than these.

4. Opening nuts at Polo Plantation. This lot of over 50,000 nuts was subsequently sulphured in the box shown in Plate 1, fig. 1. Courtesy of Mr. Detrick.

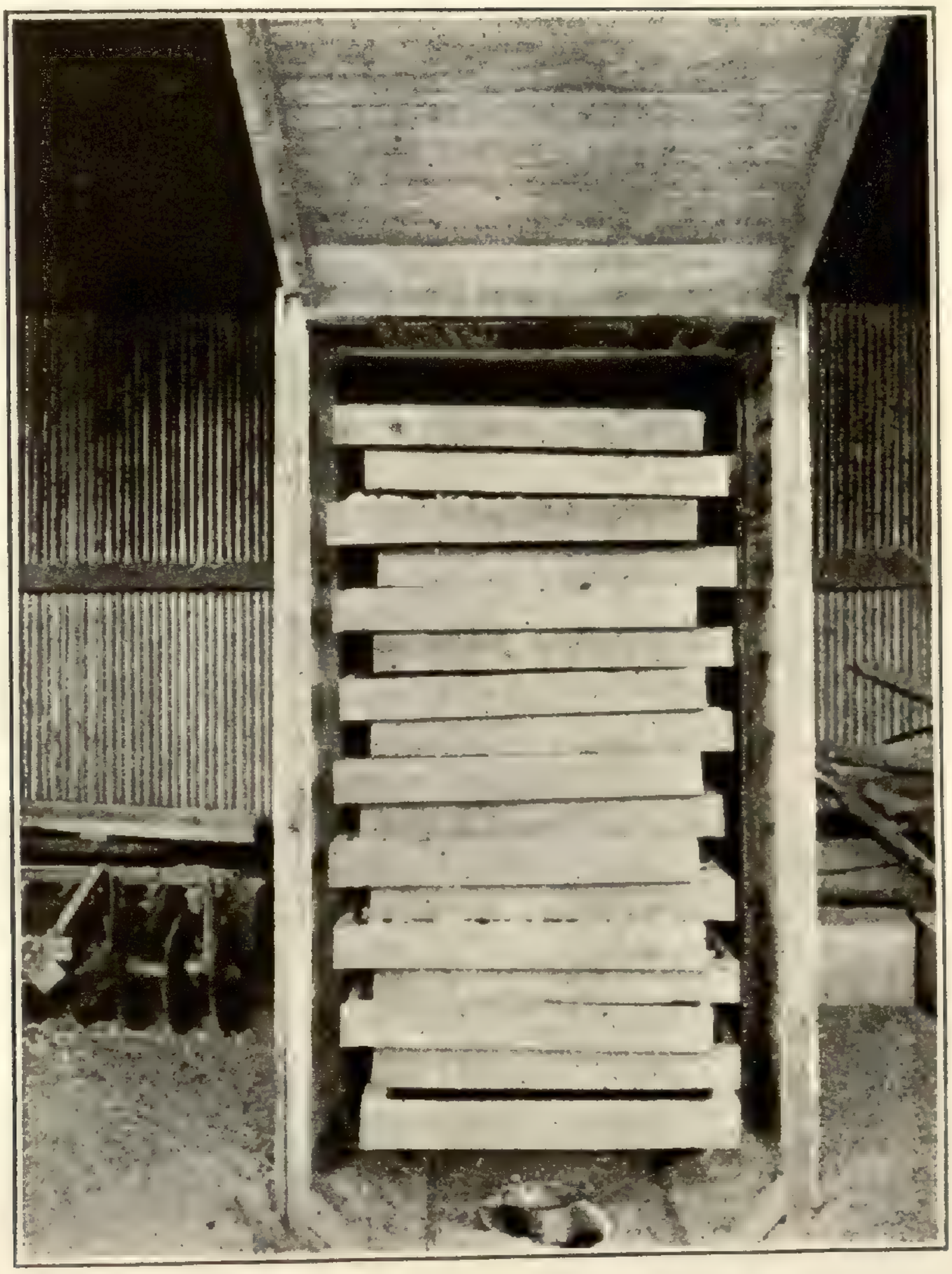

Fig. 1. Sulphuring box with sixteen trays.

Fig. 2. Sulphuring box with nine trays.

PLATE 1.

Fig. 1.

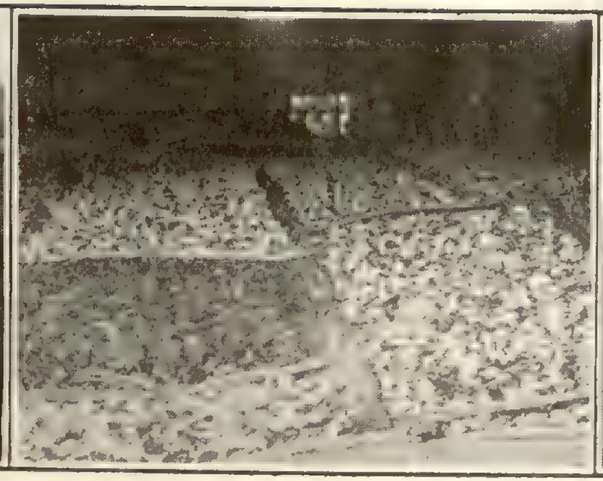

Fig. 2.

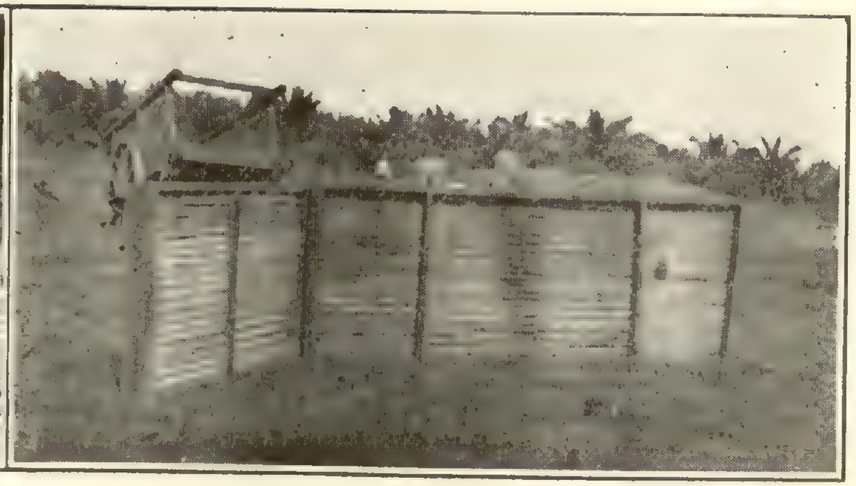

Fig. 3.

Fig. 4. Opening nuts at Polo Plantation.

PLATE 2.

HISPINEN DER ALTEN WELT

Von J. Weise

Herischdorf i. Riesengebirge, Germany

Eine Sendung von Herrn Donckier in Paris und von Herrn T. C. Moulton aus dem Sarawak Museum, sowie die Ausbeute welche Herr Drescher in neuester Zeit auf Java machte und an meinen Collegen Herrn Reineck in Berlin schickte, lieferten hauptsächlich den Stoff zu den folgenden Beschreibungen und Anmerkungen. Auch zwei sehr hübsche Arten von den Philippinen konnte ich einfügen.

Botryonopa grandis Baly.

Das Weibchen, 26 Millimeter lang, hat eine einfache Hinterbrust und vor dem abgestutzten Hinterrande des letzten Abdominalsegmentes eine sehr grosse Grube, die doppelt so breit wie lang und einem Kreisabschnitte ähnlich geformt ist, während das kleinere Männchen im vorderen Teile der Hinterbrust zwei nebeneinander liegende Zähnchen und im Hinterrande des letzten leicht gewölbten Bauchsegmentes eine schwache Ausrandung besitzt.

Anisodera modesta sp. nov.

Supra brunneo-rufa, subtus rufo-picea, antennis saepe nigris, articulis quinque basalibus supra, quatuor subtus subglabris, nitidis, prothorace latitudine longiore antrorsum leniter angustato, disco sat crebre punctato, elytris nitidulis fortiter et regulariter striato-punctatis, tenuissime costatis, apice leviter emarginatis.

Long., 13 ad 15 mm.

Borneo, Matang, April, 1902, 3200 F.; Kuching, September 19, 1899; Rook Road, August 9, 1909; Mount Saribu, Mai, 1902 (Museum Sarawak).

Mit *A. sheppardi* am nächsten verwandt, durchschnittlich kleiner als diese und bedeutend schlanker, die Fühler etwas dünner und ihre ersten fünf Glieder an der Spitze nicht knotig verdickt, die Flügeldecken ganz ähnlich stark, aber regelmässiger

punktirt, mit kleinerer Spitzenausrandung, die Rippen viel feiner und die erste nie vor der Mitte ausgebildet.

Schlank gebaut und mässig gewölbt, oben dunkel bräunlich rot, unten pechbraun oder schwarz, ähnlich auch die Fühler gefärbt, Schildchen schwarz, die Nahtkante der Flügeldecken dahinter ein kurzes Stück angedunkelt. Stirn ziemlich schmal, matt, zur Mittelrinne abfallend. Halsschild um ein Drittel länger wie breit, cylindrisch, matt, die Seiten ziemlich parallel, vorn leicht convergirend, die Scheibe ziemlich dicht und kräftig punktirt, die Mittellinie vor der Mitte glatt und in der Regel erhöht und glänzend. Flügeldecken schwach glänzend, stark in regelmässigen Reihen punktirt, nur die fünfte und sechste (ganze) Reihe hinter der Mitte durch einige dazwischen tretende Punkte leicht gestört; die Rippen sind scharf, aber fein, die erste ist nur im letzten Drittel oder Viertel vorhanden und schwächer wie die übrigen, die zweite und dritte sind normal.

Anisodera integra sp. nov.

Supra opaca, antennis, scutello corporeque subtus piceis, antennis articulis quinque supra, quatuor subtus subglabris, nitidis, prothorace longiore quam lato, utrinque leniter angustato, crebre punctato, cum capite obscure ferrugineo, elytris dilute flavo-testaceis, subtiliter striato-punctatis, apice communiter rotundatis, haud emarginatis, dorso tenuiter costatis, costa prima medio longe interrupta.

Long., 13 mm.

Borneo, Kuching, Mai, 1900 (Museum Sarawak).

Der vorigen ähnlich, die Flügeldecken jedoch heller gefärbt wie der Vorderkörper, matt, das Halsschild etwas dichter, die Flügeldecken feiner und flacher punktirt und an der Spitze schmal gemeinschaftlich abgerundet, ohne Ausschnitt.

Unterseite, Fühler, und Schildchen pechschwarz, Kopf und Thorax dunkel rotbraun, Flügeldecken blass rötlich gelbbraun. Fühler kräftig, die ersten fünf Glieder cylindrisch, oben fast glatt, glänzend, unten Glied 5 eben so dicht wie die folgenden behaart. Stirn schmal, zur Mittelrinne abfallend. Halsschild um ein Viertel länger als breit, beiderseits leicht verengt, dicht punktirt, ein kleiner gerundeter Raum der Mittellinie vor der Mitte glatt. Flügeldecken fein und wenig tief gereiht-punktirt, die Rippen schmal und ziemlich scharf, die erste ungefähr von ein bis drei Viertel der Länge unterbrochen, die zweite im ersten Viertel erloschen, die Schulterrippe ganz.

Anisodera marginella sp. nov.

Nigra vel picea, fronte, prothorace (lateribus exceptis) elytrisque ferrugineis; antennis articulis quinque supra, tribus subtus subglabris, nitidis, prothorace longiore quam lato, subcylindrico, sat crebre punctato, elytris sat subtiliter striato-punctatis, apice parum emarginatis, limbo angusto laterali postice abbreviato nigro.

Long., 12 ad 15 mm.

Matang, Februar 14, 1900; Sior, Juni 1, 1910 (Museum Sarawak).

Wie *A. modesta* gebaut, aber das Halsschild noch etwas länger, die Flügeldecken feiner und hinten verworrener punktirt, ohne recht deutliche Rippen, an der Spitze mit einer sehr kleinen, jedoch etwas tieferen Ausrandung und auf der Unterseite der Fühler nur drei Glieder glänzend; *A. testacea* Gestro hat einen viel kürzeren Thorax.

Schwarz bis rötlich pechbraun, Stirn, Thorax, und Flügeldecken blass rostrot, ein schmaler Seitensaum des Halsschildes und der Flügeldecken (auf diesen hinten mehr oder weniger abgekürzt) schwarz. Stirn zwischen den Augen sehr schmal, Thorax etwas mehr als um ein Drittel länger wie breit, cylindrisch, vor und hinter der Mitte unbedeutend ausgerandet, ziemlich dicht punktirt, matt. Flügeldecken wenig glänzend, fein gereiht-punktirt, die Reihen hinter der Mitte meist sehr verworren; von den Rippen ist nur die zweite in den hinteren zwei Dritteln angedeutet, ausserdem sind vor der Spitze kurze Stücke der übrigen zu bemerken.

Anisodera sinuata sp. nov.

Testacea vel obscure ferruginea, subtus obscurior, antennis (saepe), scutello pedibusque nigris, illis articulis primis quatuor supra, tribus subtus subglabris, nitidis, prothorace longiore quam lato, subcylindrico, minus crebre punctato, basi late depresso, elytris sat subtiliter striato-punctatis, obsolete bicostulatis, apice rotundatim-emarginatis.

Long., 9 ad 13 mm.

Matang, December 29, 1909; Januar 7 und Mai 31, 1910. (Museum Sarawak).

Eine der kleineren Arten; durch die Fühler, an denen die vier Basalglieder oben und drei unten fast kahl und glänzend sind, das lange Halsschild, und die verhältnismässig fein punktirten Flügeldecken zu erkennen, welche in der Spitze einen bogenför-

migen Ausschnitt besitzen, der merklich länger wie der von *A. sheppardi* ist. Von den primären Rippen ist die zweite schmal, niedrig, aber deutlich zu erkennen, während die dritte noch schwächer ist und wenig in die Augen fällt. Der Penis bildet eine schwach gekrümmte und von oben leicht zusammengedrückte Röhre, welche etwa so lang wie der Bauch und von der Basis aus allmählich bis vor die Mitte der Oeffnung leicht erweitert ist, dann verengt sie schnell, gerundet, in eine breite, aufgebogene, wenig vortretende Spitze.

Die Gattung *Anisodera* s. str. hat eine eigene Skulptur der Flügeldecken, die aus 10.5 Punktreihen und 3 primären Rippen besteht. Die erste Rippe, die von der Naht durch die abgekürzte Punktreihe am Schildchen und die beiden ersten ganzen Reihen getrennt wird, ist ganz, zum Beispiel bei *A. guerini,* oder in der Mitte unterbrochen (*A. lucidiventris*), bei vielen Arten nur im letzten Drittel bemerkbar, selten völlig geschwunden; die zweite liegt normal, zwischen der vierten und fünften ganzen Punktreihe und ist nur in einigen Arten (*A. scutellata, A. guerini*) ganz, sonst vorn abgekürzt; die dritte liegt vorn normal zwischen der sechsten und siebenten Punktreihe, biegt in etwa ein Drittel der Länge etwas nach aussen und wird secundär, da sie die siebente und achte Punktreihe bis zur Spitze trennt. Auf dem hinteren Abfalle der Flügeldecken bildet sich bei vielen Arten jedoch neben ihr noch ein kurzes Stück der dritten primären Rippe aus. Von den ersten Fühlergliedern sind an der Spitze knotig verdickt: Glied 1 bis 5 bei *A. sheppardi,* 2 bis 5 bei *A. sculpticollis,* 3 bis 5 bei *A. whitei* und 3 bis 6 bei *A. scutellata.* Nach den Beschreibungen könnten vielleicht folgende, im Cataloge von mir unter *Lissochila* aufgeführte Arten zu *Lassiochila* gehören: *humilis, nasuelli, propinqua,* und *testacea.*

Genus **DRESCHERIA** novum

Corpus valde elongatum, subparallelum, depressiusculum. Antennae sat breves, 11-articulatae, articulis 5 ultimis dilatatis. Frons inter antennas in cornum subquadratum producta. Prothorax subquadratus, pone medium leviter angustatus. Elytra prothorace vix latiora et plus quam quintuplo longiora, apice angustata et subtruncata, angulo suturali dentiformi instructa, dorso in seriebus 8.5 punctato striata, subtiliter tricarinulata, carinis internis antice longe deficientibus. Pedes breves.

Diese Gattung gehört in die Gruppe der Cryptonychinen zwischen *Octodonta* und *Bronthispa* und unterscheidet sich von den verwandten Gattungen durch die Flügeldecken, welche nicht

10.5, sondern 8.5 Punktreihen und 3 zarte Rippen besitzen, von denen die beiden inneren nur nahe der Spitze vorhanden sind. Die Stirn ist viereckig, etwas breiter als lang, eben, jederseits von einer Augenleiste begrenzt, vorn schnell zu einem halb so breiten, mässig langen Fortsatze verengt, welcher fast quadratisch und oben concav ist. Der Clypeus ist gross, lang, annähernd rechteckig, aber nach oben etwas verschmälert, abgeflacht, mit einer niedrigen, stumpfen Mittelleiste, fein runzelig punktirt und dicht aufstehend behaart. Die Fühler sind kurz und reichen kaum bis zur Basis der Flügeldecken, Glied 1 dick, keulenförmig, 2 halb so lang und dick, 3 kleiner als 2, etwas länger wie eins der drei folgenden Glieder, die fünf Endglieder sind erweitert, etwas zusammengedrückt, jedes wenig breiter und etwa so lang als 2, das letzte Glied eine Spur länger, mit verrundeter Spitze. Der Thorax hat ungefähr die Form wie bei einer *Downesia*, er ist etwa so lang als breit, mit abgerundeten Vorder- und rechtwinkeligen Hinterecken, an den Seiten unbedeutend nach hinten verengt und dicht hinter der Mitte sanft ausgebuchtet, auf dem Rücken schwach querüber gewölbt. Flügeldecken in den Schultern so breit wie der Thorax am Vorderrande, in ein Drittel der Länge wenig eingeschnürt, dann ziemlich parallel, im letzten Viertel sanft verengt und an der Spitze gerundet-abgestutzt, mit vortretender Nahtecke; auf dem Rücken abgeflacht. Beine kräftig und sehr kurz, das vierte Tarsenglied kaum länger wie die Lappen des dritten Gliedes, Klauen einfach, gegenständig.

Ich nenne die Gattung nach Herrn Drescher, der in den letzten Jahren mit ausgezeichnetem Erfolge auf Java gesammelt hat.

Drescheria reinecki sp. nov.

Nigra, nitida, fronte subtiliter ruguloso-punctata, prothorace substrigoso-punctulato, linea media lata sublaevi, elytris subtiliter striato-punctatis.

Long., 6 ad 7; lat. 1 ad 1.2 mm.

Java, Mount Merbabu, Mai, 1912 (*Drescher*).

Sehr langgestreckt, abgeflacht, glänzend schwarz. Stirn dicht und fein runzelig-punktirt, nur der Fortsatz oben glatt. Thorax auf einem breiten Mittelstreifen weitläufig mit äusserst feinen Punkten besetzt, fast glatt, an den Seiten mässig dicht punktulirt und vor der Mitte längsgestrichelt. Flügeldecken mit 8.5 feinen Punktreihen, die in flachen und feinen, erst hinter der Mitte tieferen Streifen stehen. Die dritte primäre Rippe ist

fein und niedrig, ganz, die beiden anderen sind kräftiger, aber nur im letzten Viertel vorhanden, auch die Naht is hinter der Mitte erhöht.

Bronthispa javana sp. nov.

Valde elongata, depressiuscula, flavo-ferruginea, nitida, antennis piceo-nigris, fronte ruguloso-punctata, prothorace subquadrato, crebre punctato, carinula obsoleta, utrinque medioque postico disci sublaevibus, elytris striato-punctatis (seriebus 5 ad 8 ante medium et seriebus 3 ad 6 juxta apicem series duas formantibus), apice bicarinatis, truncatis.

Long., 9 mm.

Java, Samarang (*Drescher*).

Der mir unbekannten *B. longissima* von der Aru-Insel Wokan nahe verwandt, die Erweiterung der Thoraxseiten hinter dem Vorderrande ziemlich breit abgerundet und die Spitze der Flügeldecken gradlinig abgestutzt.

Sehr lang gestreckt, abgeflacht, gelblich rostrot, glänzend, die Flügeldecken etwas dunkler, mit einem kaum merklichen bläulichen Anfluge versehen; Fühler pechschwarz, Glied 1 lang und dick, fast cylindrich, 2 das kleinste, wenig länger als breit, 3 etwas länger wie 2, beide zusammen kürzer als Glied 1, die drei folgenden Glieder unter sich ziemlich gleich, jedes länger als 3, von den fünf breiteren, leicht zusammengedrückten Endgliedern ist Glied 7 länger als eins der folgenden und an der Innenseite, die übrigen gänzlich, dicht, äusserst kurz, und fein behaart. Stirn quadratisch, abgeflacht, dicht und etwas runzelig punktirt, mit feiner Mittelrinne, die auf den schmalen, stabförmigen, vorn abgestutzten Fortsatz übergeht. Kopfschild lang, dicht abstehend gelblich behaart. Thorax etwas länger als breit, mit convexem Vorderrande vor den Hinterecken, die durch einen Einschnitt dornförmig abgesondert sind, zunächst leicht erweitert, dann bis zum ersten Drittel schwach verengt, hierauf in einen abgerundeten Vorsprung erweitert, der vorn fast gradlinig verschmälert ist. Auf dem Vorsprunge liegt eine niedrige, verloschene und schräg nach innen und hinten ziehende Leiste, welche nebst einem Raume vor dem Schildchen glatt erscheint, aber unter stärkerer Vergrösserung zart punktulirt ist; die übrigen Teile sind dicht punktirt. Die Punktreihen der Flügeldecken sind regelmässig, aber die dritte bis sechste Reihe hinten, die fünfte bis achte vor der Mitte auf zwei Reihen beschränkt. Auf dem Abfalle zur Spitze sind ausser der erhöhten Naht noch die beiden ersten primären Rippen deutlich ausge-

prägt und die Spitze ist von der ersten Rippe der einen Decke bis zu der der andern abgestutzt. Die Zwischenstreifen sind äusserst fein punktulirt.

Xiphispa obligata sp. nov.

Elongata, dilute rufo-testacea, supra subopaca, capite antennisque obscurioribus, elytris nigris. Prothorace sat crebre punctato lateribus pone apicem angulatis, elytris crebre striato-punctatis, carinulis primariis subtilissimis, sat obsoletis, tertia antice longe abbreviata.

Long., 7 mm.

Java, Salatiga.

Die vorliegende Art bildet das bisher unbekannte Bindeglied zwischen den Arten von Neu-Guinea und Madagascar; sie erinnert in der Färbung am meisten an *X. meijerei.* Der Körper ist langgestreckt, wenig gewölbt, rötlich gelbbraun, oberseits fast matt, Flügeldecken schwarz, Kopf und Fühler dunkel rostrot, die Spitze der letzteren und der Hals schwärzlich. Fühler schlank, alle Glieder deutlich getrennt, die fünf fast kahlen Endglieder nur unbedeutend stärker als die vorhergehenden, so dass die Art zu *Xiphispa* i. sp. gestellt werden muss. Stirn quadratisch, eben, dicht runzelig punktirt, mit einer Mittelrinne, die sich auf das schmale, stäbchenförmige, vorn abzestutzte Kopfhorn verlängert. Thorax etwas länger als breit, ziemlich dicht punktirt, die Seiten hinten fast parallel, vor der Mitte in einen kleinen stumpfwinkeligen Zahn erweitert, davor convergirend, die Vorderecken in Form eines sehr kurzen Kegels vortretrend. Schildchen glatt. Flügeldecken in den stumpfwinkeligen Schultern merklich breiter wie das Halsschild, sodann ziemlich von gleicher Breite, nur hinter der Schulter leicht eingezogen, am Ende gemeinschaftlich abgerundet; dicht und ziemlich stark in regelmässigen Reihen punktirt. Zwischenstreifen sehr schmal; die graden wenig höher wie die ungraden und feine Leisten bildend, von denen die dritte vor der Mitte fehlt, weil die Punktreihen 5 bis 8 daselbt auf zwei verringert sind.

Prionispa magnifica sp. nov.

Cuneiformis, subtus ferruginea, femoribus, tibiis antennisque pallide flavis, his articulis quatuor ultimis nigris, supra metallico-viridis, elytris flavo et cupreo marginatis, angulo postico extremo lobatis, dorso carina prima pone medium, secunda medio cupreis instructis.

Long., 3.5 mm.

Luzon, Mount Maquiling (*Baker*).

Kleiner als *P. gemmata* und *P. pulchra,* der hintere Aussenwinkel der Flügeldecken nicht zugespitzt oder dornförmig wie bei diesen, sondern in einen schräg nach aussen und hinten gerichteten dreieckigen, an der Spitze breit abgerundeten Lappen erweitert; von *P. vethi* durch helle Fühlerfarbe und die hinter der Mitte der Flügeldecken fehlenden Höcker, von *P. longicornis* endlich durch die sehr abweichende Skulptur der Flügeldecken verschieden.

Die Unterseite ist glänzend bräunlich rostrot, der Bauch heller; Schenkel, Schienen, und Fühler blassgelb, die vier Endglieder der letzteren tief schwarz. Die Oberseite ist glänzend und lebhaft metallisch grün, Stirn und Thorax goldgelb überflogen, ein breiter Seiten- und Hinterrandsaum der Flügeldecken blassgelb, innen bräunlich-kupferig angehaucht, ebenso der Ecklappen jeder Flügeldecke und der vorhandene Rest der beiden ersten Rippen. Die erste ist ungefähr im vierten Fünftel der Länge, die zweite im mittleren Drittel ausgeprägt. Stirn sparsam punktirt, vorn in einen dreieckigen Zipfel ausgezogen. Drittes Fühlerglied nur etwas länger als eins der beiden ersten Glieder. Thorax dicht und stark punktirt, in der Mittellinie glatt. Die Punkte in den Reihen der Flügeldecken sind denen des Halsschildes ähnlich, die der letzten Reihe aber stärker.

Javeta moultoni sp. nov.

Elongata, nigra, fronte prothorace apice femoribusque posticis brunneo-rufis. Prothorace foveis septem parce punctatis (anterioribus pubescentibus), elytris fortiter striato-punctatis, tricostulatis.

Long. vix 5 mm.

Borneo, Sarawak, Baram, November 10, 1910 (Museum Sarawak).

Schwarz, mässig glänzend, Oberlippe rotgelb, die Stirn bräunlich rot, ähnlich, doch dunkler, auch das Halsschild nach der Basis hin und die Hinterschenkel; die vier ersten Bauchsegmente am Hinterrande fein gelblich gesäumt. Stirn spiegelglatt, Thorax kaum so lang als breit, an den Seiten sehr wenig gerundet und vorn undeutlich, hinter der Mitte merklicher eingeschnürt, oben gewölbt aber sehr uneben; das erste Drittel wird von einem etwas niedergedrückten, in der Mitte sparsam und grob punktirten, nach den Seiten hin dicht punktulirten und dicht kurz und

fein aufstehend behaarten [1] Querstreifen eingenommen, welcher nahe dem Rande in eine tiefe Grube übergeht. Hinter dieser befindet sich je eine ähnliche aber kahle Grube, beide stark punktirt. Im mittleren Teile der Scheibe liegen drei kleinere, mit wenigen groben Punkten besetzte Gruben, zwei am Basalrande dicht neben einander und eine davor. Die Flügeldecken sind fast parallel, hinter der Mitte wenig verbreitert, auf dem Rücken in regelmässigen, leicht vertieften Reihen stark und sehr dicht punktirt. Die drei secundären Rippen liegen normal (die erste zwischen der dritten und vierten Punktreihe) und sind deutlich, wenn auch nicht besonders stark, nur die dritte ist sehr schmal und fein.

Diese Art erlaube ich mir nach dem Curator des Sarawak Museums Herrn J. C. Moulton zu benennen.

Coelaenomenodera cucullata Guer. ist nach der Fühlerbildung eine *Balyana*, denn die vier Endglieder bilden einen dicht behaarten matten Cylinder, an welchem die Nähte nur leicht angedeutet sind. Die ersten sieben Glieder sind getrennt, sparsamer behaart, und mässig glänzend. Glied 1 ist kurz, dick, 2 wenig kürzer aber dünner, 3 schlank, doppelt so lang als 2 und von allen das längste, 4 merklich kürzer, 5 wenig kürzer wie 4, 6 dem zweiten ähnlich, 7 so lang als 5 aber nach der Spitze verdickt und hier so breit als das Endglied. Der Körper ist 9 bis 10.5 Millimeter lang, glänzend rotgelb, die Tarsen angedunkelt und das zusammengesetzte Endglied der Fühler schwarz. Thorax länger als breit, grob punktirt, nur die Zwischenwände der sechs Gruben (2, 2, 2) glatt und stark glänzend. Die beiden ersten Gruben (auf der über den Kopf vorgezogenen und vorn abgerundeten Kapuze) sind gross, sehr tief, lang eiförmig, die folgenden vier flach und viel kleiner, quer. Flügeldecken grob punktirt-gestreift, die Intervalle bilden feine Leisten, von denen die dritte, fünfte, und siebente nur unbedeutend stärker als die andern sind.

Coelaenomenodera cucullata var. fuscicornis var. nov.

Ueber das variiren der *Coelaenomenodera* ist aus Mangel an Material zur Zeit wenig bekannt und ich kann hier auch nur zwei Fälle anführen. Im Hamburger Museum steckt ein Exemplar mit der allgemeinen Fundortsangabe Madagaskar

[1] Die Behaarung der vorderen Thoraxgruben von mir bereits Arch. f. Naturgesch. (1905) 98 erwähnt, scheint der Gattung *Javeta* wirklich eigentümlich zu sein.

(*Kiderlen*), welches ich noch zu *C. cucullata* rechne, obwohl an den Fühlern die beiden ersten Glieder allein bräunlich rot, die folgenden (ausser dem tief schwarzen zusammengesetzten Endgliede) pechbraun sind. Auch die Kapuze ist vorn nicht gleichmässig abgerundet, sondern gerundet-abgestutzt. Ich bezeichne dies Tier als var. *fuscicornis*.

Sodann besitze ich ein Stück aus Madagaskar (*Staudinger*) von *Balyana armata* Gestro, welches in folgenden Punkten von der Beschreibung der einzigen Type abweicht: Die Fühler sind nicht 9- sondern regelrecht 8-gliedrig, Glied 1 bis 3 unter sich an Länge gleich, 4 bis 6 jedes eine Spur kürzer, 7 dagegen um die Hälfte länger, nach oben verbreitert und an der Spitze auch um die Hälfte breiter als 6, das zusammengesetzte achte Glied ist wenig dicker als 7 und so lang wie Glied 6 und 7 zusammen, am Ende mässig scharf zugespitzt. Die Flügeldecken haben an der hinteren Aussenecke keinen spitzen, nach hinten gestreckten Zahn, sondern eine stumpfwinkelige Ecke, welche durch die plötzliche Verengung des abgesetzten Seitenrandes entstanden ist. Dieses Stück dürfte das andere Geschlecht von *B. armata* sein, eine Art, welche von den übrigen durch die nur von einer Grube eingenommenen Kapuze abweicht.

Coelaenomenodera suturalis Guer.

Die schwarze Mittelbinde des Thorax nimmt an der Basis mehr als das mittlere Drittel der Breite ein, ist davor plötzlich stark verengt und endet in einer Spitze, die weit vom Vorderrande entfernt bleibt.

Madagaskar, Maroantsetra (*Staudinger*).

Coelaenomenodera funerea sp. nov.

Elongata, subtus nigra, supra atra, prothorace crebre et fortiter subrugoso-punctato, cucullo subtriangulari lineisque tribus obsoletis nitidis, elytris valde striato-punctatis, transversim plicatis, tricarinulatis.

Long., 11 mm.

Madagaskar, Tananarive.

Der *C. distinguenda* Fairm. sehr nahe stehend und vielleicht nur eine einfarbig schwarze Form derselben, aber die Fühler etwas länger wie die von *C. femorata* und die dritte (secundäre) Rippe der Flügeldecken hinten kaum schwächer wie die beiden inneren.

Die Fühler reichen bis an die Basis der Flügeldecken und sind ziemlich dick, Glied 1 und 2 klein, sparsam behaart, glänzend, die folgenden länger und breiter, matt, 3 bis 5 an den Seiten

deutlich länger behaart als die folgenden, Glied 8 bis 10 etwas kürzer wie die vorhergehenden und allmählich verdünnt, nur durch eine leichte Einschnürung getrennt, das Endglied stumpf zugespitzt. Scheitel glatt, durch eine unregelmässig verdoppelte, starke punktreihe von der Stirn geschieden; auf dieser laufen zwei parallele Längsleisten nach vorn bis zwischen die Fühler und schliessen einen dicht punktirten und grau behaarten Streifen ein. Thorax von der Basis bis vor die Mitte allmählich schwach verengt, davor wieder erweitert, hinter den höckerartig heraustretenden Vorderrande ausgeschnitten, letzterer kapuzenförmig weit über den Kopf vorgezogen, glänzend, und mit zwei lang eiförmigen Gruben besetzt. Der übrige teil der Scheibe ist grob, sehr dicht punktirt, und hat drei feine, unregelmässige, glatte Längslinien. Flügeldecken bedeutend schlanker wie die von *C. femorata*, mit dicht nebeneinander stehenden Reihen von grossen und tiefen viereckigen, durch eine Querleiste getrennten Punkten und drei ziemlich schmalen Längsrippen. Die zweite geht vorn, nahe der Basis, in eine Punktreihe über, die dritte ist vor der Mitte niedriger wie hinter derselben.

Das einzige Stück befindet sich in der Sammlung von Herrn Donckier.

Coelaenomenodera donckieri sp. nov.

Elongata, parallela, rubra, nitida, antennis fulvis, articulis quinque ultimis dilatatis, clavam formantibus, articulis tribus apicalibus nigris; prothorace subpolito, basi impresso, cucullo magno, fere semicirculari, foveis duabus magnis, punctatis impresso, elytris striato-punctatis.

Long., 4 ad 4.5 mm.

Madagaskar, Tananarive, Mahatsinjo (*Donckier, Staudinger*).

In Grösse und Farbe der *C. coccinea* am ähnlichsten, aber von ihr und den anderen roten Arten durch die fehlenden Rippen der Flügeldecken und die grosse, ziemlich halbkreisförmige Kapuze welche die vordere Hälfte des Thorax bildet und weit über den Kopf reicht, auf den ersten Blick zu unterscheiden.

Gestreckt und parallel, lebhaft glänzend rot, Fühler rötlich gelb, ihre drei Endglieder und oft noch die Spitze des achten Gliedes schwarz, die ersten sechs Glieder ziemlich kräftig, Glied 2 etwas länger als eins der übrigen, 7 mässig, die folgenden etwas stärker erweitert, das Endglied kurz, konisch. Halsschild in der hinteren Hälfte glatt, mit einer verloschenen Grube vor dem Schildchen und zwei grösseren und tieferen Seitengruben an der Basis; die vordere Hälfte wird von den beiden annähernd

halbkreisförmigen, kräftig punktirten Gruben der Kapuze eingenommen. Flügeldecken in regelmässigen Reihen nicht stark punktirt, ein Stück hinter der Basis quer eingedrückt, ausserdem noch mit einer anderen weiten Vertiefung in der Mitte zwischen der vierten und siebenten Punktreihe versehen, an deren Aussenrande die dritte secundäre Rippe auf eine kurze Strecke angedeutet wird. Die übrigen Zwischenstreifen sind eben und fast glatt.

Coelaenomenodera straminipennis sp. nov.

Elongata, straminea, nitidissima, antennis brunneo-rufis apice infuscatis, capite, prothorace laevi, postpectore utrinque tarsisque dilute brunnescentibus; cucullo rotundatim subquadrato, bifossulato, elytris striato-punctatis, tricarinatis, carina secunda medio interrupta, tertia antice deficiente.

Long., 6.5 mm.

Madagaskar, Tananarive, Mahatsinjo (*Donckier*).

In der Körperform mit *C. pallescens* übereinstimmend und auch in der Form der Halsschildkapuze ihr ähnlich, aber abweichend gefärbt, viel glänzender und durch die Skulptur der Oberseite völlig verschieden.

Strohgelb oder blass rötlich gelb, oberseits stark glänzend, Kopf und Thorax bräunlich gelb, eine verloschene Makel an den Seiten der Hinterbrust und die Tarsen hell rötlich braun, das zweite bis sechste Fühlerglied rotbraun, das siebente und achte angedunkelt, letzteres eine Spur dicker und um die Hälfte länger als das vorhergehende; die folgenden fehlen. Thorax länger wie breit, hinter der Mitte ziemlich parallel, die Kapuze davor etwas schmäler, von oben betrachtet an den Seiten ziemlich parallel, vorn über den Kopf vorgezogen und abgestutzt, mit breit abgerundeten Aussenecken und zwei sehr tiefen ovalen Gruben, welche durch eine mässig breite glatte Zwischenwand getrennt sind. Die Scheibe dahinter ist glatt und besitzt drei Eindrücke an der Basis und (wie bei den meisten anderen Arten) über dem Seitenrande zwei Längsvertiefungen, die von der Scheibe durch eine fast grade Leiste getrennt werden. Die Flügeldecken treten an der Basis schräg heraus und sind in den Schultern bedeutend breiter wie der Thorax, dahinter ziemlich parallel, jedoch hinter dem ersten Drittel durch den heraustretenden abgesetzten Seitenrand leicht erweitert, auf der Scheibe gereiht-punktirt, mit drei secundären Rippen. Diese haben ungefähr dieselbe Höhe, die erste ist im vorderen Drittel abgeflacht, die zweite kurz, in der Mitte unterbrochen, davor undeut-

lich, die dritte ist länger wie die zweite und erlischt allmählich vor der Mitte.

Von Mahatsinjo schickte Herr Donckier noch *C. chermesina*, *C. coccinea* und *C. ornata* ein.

Promecotheca straminipennis sp. nov.

Elongata, nigra, nitida, capite, thorace scutelloque sublaevibus, elytris, flavo-albidis vel stramineis creberrime striato-punctatis, parum nitidis, femoribus posterioribus dentatis.

Long., 11 mm.

Neu-Pommern (*Staudinger*).

Diese Art ist zwar ähnlich gefärbt wie *P. callosa*, aber viel schlanker gebaut und auf den Flügeldecken ganz abweichend punktirt. Sehr lang gestreckt, tief schwarz, glänzend, die Flügeldecken blass strohgelb, wenig glänzend. Kopf und Halsschild äusserst fein und schwer sichtbar gewirkt, letzteres mit einigen zarten Pünktchen jederseits in der vorderen Hälfte, hinten tief quer eingedrückt und eingeschnürt, davor an den Seiten keulenförmig erweitert und auf dem Rücken jederseits mit einer tiefen Grube versehen. Schildchen hinten breit gerundet-abgestutzt, deutlicher gewirkt wie der Thorax. Flügeldecken unbedeutend breiter wie der Vorderkörper, fast parallel, nur hinter der Schulter wenig ausgeschweift, hinten gerundet-verengt und in eine gemeinschaftliche kurze und stumpfe Spitze verlängert, oben wenig gewölbt, dicht gereiht-punktirt, die Punkte von mässiger Grösse. Es sind vorn zehn Punktreihen vorhanden, die in ein Drittel der Länge auf acht oder neun verringert, gleich darauf aber wieder auf zehn vermehrt sind. Die zwei ersten Reihen sind regelmässig, die beiden folgenden Reihen vermehren sich von etwa ein Viertel der Länge ab zunächst in drei, später in vier Reihen, während die sechste und siebente sich in ein Drittel der Länge mit der fünften verbinden und nun als eine Reihe bis vor die Spitze laufen. Eine ähnliche Streifung der Flügeldecken findet sich bei keiner anderen Art, denn die mit *P. cyanipes* verwandten Tiere haben vorn zehn, hinter der Mitte elf bis zwölf Reihen, da die dritte und vierte dort eine oder zwei Zwischenreihen erhalten.

Promecotheca antiqua Ws. ist in Neu-Pommern ein lästiges Tier geworden, da sie in den letzten Jahren mehrere Palmenpflanzungen vollständig verwüstet hat. Sie legt ihre Eier in den Vegetationskegel der jungen Pflanzen, den die zahlreichen Larven allmählich zerstören und so den Stamm zum absterben bringen. Kürzlich erhielt ich einiges Material durch meine

Tochter Elisabeth Kaiser von der Plantage Matanatar bei Kokopo, aus dem ich ersehe, dass die Beine der Art nicht immer einfarbig gelb bleiben; es werden zunächst die Hinterbeine, später auch in geringerer Ausdehnung die Mittelbeine, pechbraun. Durch die folgende Tabelle hoffe ich die Bestimmung der meisten *Promecotheca*-Arten erleichtert zu haben:

Tabelle der Promecotheca-Arten.

1. Flügeldecken auf dem Abfalle zur Spitze halb aufstehend behaart und am Hinterrande dicht bewimpert..... 2.
1. Flügeldecken hinten kahl, vorn mit 10, hinter der Mitte mit 9, und am Ende mit 8 mässig starken und ziemlich regelmässigen Punktreihen (die erlöschenden liegen zwischen den Reihen 5 und 8). Gelb oder gelblich rot, Tarsen schwärzlich, Bauch braun oder schwarz, Fühler schwarz (Glied 1 ausgenommen), Flügeldecken dunkel metallisch blau, blaugrün oder grün, einfarbig oder (ab. *reichei* Baly) im ersten Drittel gelb. Länge 8 bis 10 mm. Tonga und Viti-Inseln. **P. coeruleipennis** Blanch.
2. Halsschild glatt oder nur mit wenigen Punkten..... 3.
2. Halsschild stark gerunzelt. Schmutzig gelb, matt; Fühler, Unterseite, und Beine (mit Ausnahme der Schenkelbasis) schwarz, Flügeldecken regelmässig in Doppelreihen punktirt, mit 3 kräftigen Rippen. Länge 9 mm. Java..... **P. petelli** Guér.
3. Flügeldecken mit 8 regelmässigen und gleichstarken Punktreihen, die nur auf der Schulter um eine vermehrt sind..... 4.
3. Flügeldecken mit 10 oder mehr Punktreihen, welche im ersten Viertel bedeutend stärker als dahinter und durch kurze kräftige Längsrippen getrennt sind..... 7.
4. Flügeldecken sehr grob und tief punktirt..... 5.
4. Flügeldecken verhältnismässig fein und flach punktirt..... 6.
5. Körper tief schwarz, nur die Flügeldecken gelb. Länge 10 bis 11 mm. Nördliches Australien, Neu-Guinea, Neu-Pommern.....**P. callosa** Baly.
5. Unterseite schwarz, Vorderschenkel, Mitte der Vorderschienen, und die Oberseite rötlich gelb, Fühler und Schildchen schwarz. Länge 11.3 mm. Nördliches Australien..... **P. varipes** Baly.
6. Hell rostrot, Flügeldecken mehr gelb, Fühler in der Regel schwarz, alle Schenkel mit einem spitzen Zahne; Thorax länger als breit, Schildchen abgestuzt, lang rechteckig. Länge 7 bis 9 mm. Philippinen, Palawan. Borneo..... **P. cumingi** Baly.
6. Hell rostrot, oben fast matt; Thorax schwach quer, Schildchen hinten abgerundet, Bauch und der grösste Teil der Beine braun, violett schimmernd, Schenkel ungezähnt. Länge 10 mm. Philippinen: Bohol. **P. octostriata** Chap.
6. Sehr schlank, rotgelb, Fühler und Bauch (letzterer teilweise oder gänzlich), zuweilen auch die Hinterbeine schwarz; Flügeldecken vor der Mitte gelb, dahinter bläulich schwarz; Mittel- und Hinterschenkel gezähnt. Länge 5.5 mm. Philippinen, Mindanao: Luzon, Los Baños; Ticao..... **P. apicalis** Ws.
7. Kopf und Halsschild rein schwarz..... 8.
7. Kopf, Halsschild, Schildchen, Unterseite, und Beine glänzend und gesättigt metallisch grün, Flügeldecken lehmgelb bis gelblich rot, fast

matt, Fühler schwarz (ab. *trilbyi* und *scorpio* Thoms.); oder Kopf, Thorax, Schildchen, Vorder- und Mittelbrust, und die Basis der Vorderschenkel gelblich rot, metallisch grün überflogen; Schildchen dreieckig, Flügeldecken im Basaldrittel mit 10 Punktreihen (die ersten 5 viel stärker und tiefer als die übrigen), dahinter mit 11 oder 12 feineren Reihen, von denen nur die beiden ersten ganz regelmässig sind. Länge 11 bis 13 mm. Philippinen, China..... **P. cyanipes** Er.

8. **Schenkel ungezähnt..... 9.**

8. Mittel- und Hinterschenkel gezähnt; tief schwarz, Flügeldecken strohgelb, vorn und hinten mit 10, in ein Drittel der Länge auf sehr kurzer Strecke mit 8 Punktreihen. Länge 11 mm. Deutsch Neu-Guinea: Neu-Pommern..... **P. straminipennis sp. nov.**

9. Langgestreckt, schwarz, Beine rostrot, Hinterbrust pechbraun, Thorax in der mitte zart gewirkt, hinten und an den Seiten fein gestrichelt und sparsam punktulirt, fettig (♀) oder stärker glänzend (♂), Flügeldecken parallel, dunkel metallischgrün, seltener blau, vorn gelb, beide Farben durch eine leicht concave Linie getrennt, die etwas hinter dem Schildchen beginnt und in der Nähe des ersten Drittels am Seitenrande endet. Die Punktreihen der Flügeldecken werden hinter dem ersten Viertel durch ziemlich feine Querrunzeln gestört. Länge 9 bis 11 mm. Neue Hebriden..... **P. opacicollis** Gestro.

9. Mässig gestreckt, Flügeldecken nach hinten erweitert, schwarz, die drei ersten Fühlerglieder ganz oder zum teil, Schildchen und Beine hell rostrot, Flügeldecken gelb, das letzte Drittel schwarzblau, vorn durch eine gemeinschaftliche, schwach concav gebogene Linie begrenzt, die Punktreihen hinter der Basis durch ziemlich kräftige Querrunzeln gestört; zuweilen ist die Mitte der Brust und des Bauches rötlich, oder die 4 hinteren Beine sind mehr oder weniger angedunkelt. Länge 7 bis 9.5 mm. Neu-Pommern. (Dieser Art müssen die mir unbekannten *papuana* und *biroi* Csiki sehr nahe stehen.).... **P. antiqua Ws.**

In der Gattung *Wallacea* hat sowohl Baly wie Chapuis die Fühlerbildung nicht richtig angegeben. Die ersten vier Glieder sind nämlich mässig glänzend, ziemlich dicht punktirt, und tragen in jedem Punkte ein äusserst kurzes weissliches Härchen; das erste Glied ist dicker und etwas länger wie eins der drei folgenden, die sich von ihrer Basis aus nach der Spitze hin erweitern. Die sieben Endglieder dagegen sind cylindrisch, äusserst dicht und fein punktulirt und behaart, matt. Bei der typischen Art, *bowringi*, sind die vier ersten Glieder dunkel rostrot, die übrigen schwarz, also nicht wie Baly sagt: "antennae black, basal joint obscure fuscous beneath."

Downesia marginicollis sp. nov.

Atra, subnitida, prothorace parce punctulato in lateribus sat late marginato, elytris brunneo-rufis nitidis, basi sublaevibus tum subtiliter striato-punctatis.

Long., 8.5 mm.

China, Tschonting (*Staudinger*).

Diese Art erinnert on *D. fulvipennis*, zeichnet sich aber durch den verhältnismässig breit abgesetzten und deutlich aufgebogenen Seitenrand des Halsschildes und die Punktirung der Flügeldecken aus, welche im grösseren Teile der vorderen Hälfte ziemlich erloschen ist.

Schwarz, wenig glänzend, die Flügeldecken dunkel bräunlich rot, glänzender. Kopf fast glatt, mit wenigen, nur bei starker Vergrösserung sichtbaren Pünktchen nahe den Augen. Halsschild etwas länger wie breit, nach hinten leicht verschmälert, sehr gering gewölbt, kaum bemerkbar gewirkt und weitläufig punktulirt, an den Seiten zu einer stärker punktirten, ziemlich breiten Rinne abfallend, welche den vorn verdickten Rand deutlich emporhebt. Auf den Flügeldecken sind die Punkte der beiden inneren Reihenpaare bis hinter die Mitte fast erloschen, die des dritten Paares fehlen auf der Schulter. Die erste Punktreihe steht der ganzen Länge nach in einer Rinne, von der sich in der Mitte die zweite abzweigt, die dritte und vierte Reihe nähern sich vor der Mitte und bilden dann bis zur Basis einen flachen Streifen; die fünfte und sechste Reihe trennen sich etwas vor der Mitte, und die beiden äusseren, deren Punkte von gleicher Stärke sind, bilden von ein Drittel der Länge bis wenig hinter die Mitte nur eine Reihe. Die erste Rippe bildet bis nahe an den Abfall zur Spitze, die zweite bis zur Mitte, und die dritte im ersten Viertel, eine ziemlich breite Fläche.

Downesia abdominalis sp. nov.

Elongata, nigra, nitida, abdomine rufo-flava, antennis sat longis, prothorace sublaevi lateribus subtiliter, marginato, elytris striato-punctatis, seriebus 7a et 8a ubique separatis.

Long., 6 mm.

Sikkim (*Staudinger*).

Aehnlich gefärbt wie *D. grandis*, sehr schlank, tief schwarz, glänzend, der Bauch rötlich gelb. Fühler länger wie in den meisten übrigen Arten, bis auf die Schulter reichend, Glied 2 etwas länger wie 1 oder 3. Halsschild wenig länger als breit, die Seiten hinter den Vorderecken schnell erweitert, sodann nach hinten allmählich unbedeutend verengt, äusserst fein gerandet, die Scheibe fast glatt, sparsam mit sehr feinen Pünktchen bedeckt. Flügeldecken in den Doppelreihen ziemlich fein punktirt, die beiden ersten vor der Mitte vereint, die erste Rippe bildet eine wenig deutliche schmale und niedrige Leiste, die beiden andern sind erloschen.

Downesia javana sp. nov.

Elongata, subdeplanata, rufa, nitida, antennis elytrisque (his basi excepta) nigris, tibiis tarsisque infuscatis; prothorace parce obsoleteque punctulato latitudine paullo longiore, lateribus evidenter marginato, elytris sat fortiter striato-punctatis, valde tricostatis.

Long., 3.5 ad 4 mm.

Java (*Drescher*).

Mit *D. sumatrana* nahe verwandt, aber nur halb so gross, dunkler gefärbt, die fünf letzten Fühlerglieder merklich dicker wie die vorhergehenden, die Punkte in den Reihen der Flügeldecken etwas feiner, dichter, die Rippen stärker.

Der Körper ist düster rot, glänzend, Fühler und Flügeldecken schwarz, letztere an der Basis unbestimmt rötlich, Schienen und Tarsen angedunkelt. Stirn glatt, mit wenigen Pünktchen zwischen den Augen. Thorax unbedeutend länger als breit, sparsam und sehr fein punktulirt, schwach gewölbt, die Seiten fast parallel, nach hinten wenig convergirend und vorn etwas gerundet verengt, über der feinen Kante des Seitenrandes mit einer vertieften Längslinie und vor dem Schildchen jederseits mit einer flachen Grube. Flügeldecken wenig breiter wie der Vorderkörper, parallel, die beiden ersten Rippen hoch und kräftig, nahe der Basis verbreitert, die dritte schwächer, die Intervalle tief, mässig stark in Doppelreihen punktirt, von denen die beiden ersten in den vorderen drei Viertel der Länge, die beiden letzten in der Mitte auf eine Reihe beschränkt sind.

Downesia sumatrana Gestro sammelte Herr Drescher im März, 1906, bei Samarang auf Java.

Die *Downesia*-Arten lassen sich in zwei Gruppen Teilen:

1. Die primären Rippen der Flügeldecken sind schmal und hoch, ihre Intervalle tief.
   a. Halsschild längsrissig: *Downesia strigicollis, angustata.*
   b. Halsschild fast glatt oder sparsam punktirt: *atrata, sulcata, basalis, picea, tarsata, insignis, sumatrana, javana.*
2. Die Rippen der Flügeldecken sind breit und flach oder kaum bemerkbar: *Downesia gestroi, fulvipennis, grandis, elegans, andrewesi, auberti, kanarensis, marginicollis, abdominalis.*

Agonia tristicula sp. nov.

Elongata, parallela, nigra, nitida, antennis articulis tribus ultimis flavo-albidis, basi femorum subtus macula rufa ornato, prothorace sat fortiter punctato margine antico linea media sat lata postice abbreviata costulaque angusta utrinque laevibus;

elytris coeruleo-nigris, fortiter striato-punctatis, tricostatis, costa tertia medio longe interrupta.

Long., 6.5 mm.

Borneo, Kuching (Sarawak Museum).

Aehnlich gefärbt wie *A. lucida*, an der Fühlerspitze ein Glied weniger weisslich und die Beine nicht einfarbig rotgelb.

Schlank, parallel, tief schwarz, glänzend, die Flügeldecken bläulich schwarz und mit Ausnahme der beiden ersten Rippen wenig glänzend, drei Endglieder der Fühler gelblich weiss und ein kleiner Fleck nahe der Basis auf der Unterseite der Schenkel rötlich gelb. Thorax so lang wie breit, vor der Mitte am breitesten und kaum schmaler wie die Flügeldecken, von hier nach vorn bis zu einem kleinen Ausschnitte hinter den Vorderecken unbedeutend, nach hinten allmählich etwas stärker, verengt, grob punktirt, ein Streifen am Vorderrande, in eine breite, hinten abgekürzte Mittellinie verlängert, sowie eine stumpfwinkelige Längsleiste jederseits über die punktirten Stellen erhöht und spiegelglatt. Flügeldecken stark in Doppelreihen punktirt, die durch drei Rippen getrennt werden. Die beiden inneren sind ganz, vorn mässig breit, nach hinten verengt, tief schwarz und spiegelglatt, die dritte ist schmal und nur nahe der Basis und vor der Spitze bemerkbar. Zwischen die dritte und vierte Punktreihe schiebt sich im ersten Drittel eine dritte Reihe ein.

Agonia luzonica sp. nov.

Elongata, subparallela, pallide rufo-flava, antennis, femorum apice, tibiis, tarsis, lateribus pectoris, abdominis et elytrorum (his in basi exceptis) nigris. Prothorace parce punctato, linea media subelevata carinulaque utrinque laevibus, elytris sat fortiter striato-punctatis, tricostatis.

Long., 5.5 mm.

Luzon (*Baker 2270*).

Var. *a*. Dimidio postico elytrorum ramulis tribus antrorsum emittente nigro.

Von den ähnlich gefärbten Arten durch die Rippen der Flügeldecken verschieden, von denen die dritte ganz und fast eben so stark ist wie die beiden inneren. *Gonophora chapuisi* Baly, die nach der Beschreibung ebenfalls zu *Agonia* gehört, weicht ausserdem noch durch rotgelbe Unterseite und Beine ab.

Gestreckt und ziemlich parallel, blass rötlich gelb, die Flügeldecken fast rein gelb, die Fühler, ziemlich die Spitzenhälfte der Schenkel, die Schienen und Tarsen, ein Streifen am Seiten-

rande der Hinterbrust und des Bauches, ein Spitzensaum der Flügeldecken, nach vorn auf der Naht bis zum ersten Viertel und am Seitenrande bis unter die Schulterbeule linienförmig verlängert, schwarz. In der var. *a* ist die hintere Hälfte der Flügeldecken schwarz und sendet einen gemeinschaftlichen, breiten, dreieckigen Zipfel auf der Naht bis zum ersten Viertel und einen schmalen Streifen am Seitenrande (innen von der dritten Rippe begrenzt) bis zur Schulterbeule. Fühler mässig lang, ihr drittes Glied um die Hälfte länger wie das zweite oder erste. Halsschild etwas breiter wie lang, an den Seiten hinten parallel, vor der Mitte schwach gerundet-verengt, auf der Scheibe ziemlich weitläufig, nach den Seiten zu dichter punktirt, eine wenig erhöhte und beiderseits abgekürzte Mittellinie nebst einer feinen, leicht gebogenen Längsleiste jederseits davon glatt. Diese Leiste begrenzt den vorderen Teil der normalen Seitengrube, die sich allmählich verschmälert bis zum Schildchen hinzieht. Auf den Flügeldecken sind die Punktreihen nicht besonders stark, aber dicht und regelmässig, nur zwischen die dritte und vierte Reihe ist vorn eine kurze Reihe eingeschoben.

Agonia chinensis sp. nov.

Elongata, postice leniter ampliata, lateritia, nitida, antennis nigricantibus basi ferrugineis, elytris nigris, nitidulis; prothorace parce punctato, antrorsum subangustato, elytris sat fortiter striato-punctatis, punctis antice seriebus septem, postice octo formantibus, costa tertia medio longe interrupta.

Long., 5 mm.

China, Kiautschau (*Staudinger*).

Durch Körperform, Farbe, und Skulptur der Oberseite ausgezeichnet. Gestreckt, nach hinten wenig erweitert, glänzend ziegelrot, Fühler schwärzlich oder pechbraun, die beiden ersten Glieder rötlich, Flügeldecken schwarz, mässig glänzend. Thorax hinten sehr sanft, nahe den Vorderecken stärker gerundet-verengt, oben gewölbt, sparsam kräftig punktirt, vor der Basis jederseits mit einem etwas dichter punktirten, schmalen, nach aussen verbreiterten Quereindrucke versehen. Flügeldecken in den Schultern wenig breiter wie das Halsschild und weniger eckig wie in den verwandten Arten, sondern mehr gerundet-heraustretend, nach hinten schwach aber deutlich verbreitert, mässig stark gereiht-punktirt, dreirippig, die Rippen kräftig, die dritte jedoch nur dicht an der Schulter und vor dem Hinterrande vorhanden. Die inneren Rippen laufen parallel, deshalb sind die ersten vier Punktreihen ganz regelmässig und vorn, zwischen

der ersten und zweiten Rippe, nicht um eine vermehrt wie in den meisten übrigen Arten; dagegen liegen auf der äusseren Hälfte nur im letzten Viertel vier, davor drei Reihen.

Agonia malangensis sp. nov.

Elongata, nigra, femoribus, tibiis, prosterno, capite (vertice excepto), prothorace (utrinque nigro-maculato) elytrorumque triente basali rufescentibus; capite laevi, prothorace parce punctato scutelloque nitidis, elytris minus nitidis, tricostatis, costa tertia medio interrupta.

Long., 3.5 mm.

Java, Malang (*Staudinger*).

Zu den kleinsten Arten gehörig, langgestreckt, fast parallel, der Vorderkörper und die Unterseite glänzend, die Flügeldecken fast matt. Unterseite schwarz, Schenkel, Schienen, und Prosternum gelblich rot, Seiten der Vorderbrust stark, die der Mittel und Hinterbrust feiner punktirt, letztere in der Mitte nebst den Bauchringen glatt, nur das Analsegment ziemlich dicht und fein punktirt. Fühler pechschwarz. Kopf gelblich rot, Stirn spiegelglatt, Scheitel schwarz. Halsschild wenig breiter wie lang, an den Seiten leicht gerundet und beiderseits schwach verengt, eine Querrinne, die den Vorderrand emporhebt und die Seiten (namentlich deren grosse Grube) ziemlich dicht punktirt, neben der etwas erhöhten Mittellinie jederseits nur wenige Punkte. Flügeldecken mit je vier regelmässigen Doppelreihen von starken Punkten und drei Rippen, von denen die beiden inneren gleichmässig kräftig sind, während die dritte nur nahe der Schulter und hinter der Mitte deutlich ist.

Agonia clavareaui Gestro.

Ein Exemplar des Sarawak Museums, Borneo; Quop, März, 1914, stimmt in allen Stücken mit der Beschreibung dieser Art überein, nur sind ausser den beiden Basalgliedern der Fühler noch die drei folgenden (wenn auch etwas dunkler) rötlich gefärbt.

Agonia (Distolaca) crassicornis Gestro.

Ist nach der Beschreibung unzweifelhaft eine *Javeta*, die ähnlich wie *gestroi* gefärbt, aber viel kleiner ist und ein kürzeres Halsschild hat. Ebenso könnte *pachycera* Gestro zu *Javeta* gehören, da der Raum von der Naht bis zur ersten Rippe mit drei Punktreihen besetzt sein soll.

Gonophora apicalis Baly.

Diese Art wurde nach einem einzelnen Stücke beschrieben; bei anderen Exemplaren von Luzon, Los Baños (*Baker*), sind die zwei ersten Fühlerglieder, die Basis des dritten, und die beiden Endglieder dunkel bräunlich rot. Die vier Vertiefungen des Thorax (eine kurze und schräge über den Vorderecken und eine längere und tiefere jederseits vor dem Hinterrande) sind mit je einer kräftigen Punktreihe besetzt. Viel stärker noch sind die Punkte in den Reihen der Flügeldecken, und deren schwarzer Spitzenfleck nimmt zuweilen etwas mehr als das letzte Drittel ein. Sein Vorderrand bildet zwischen den zweiten Rippen beider Decken eine grade Querlinie, nach aussen davon läuft er schräg nach hinten.

Anisodera nigricauda Motsch. gehört nicht zu *Micrispa,* wie ich [2] vermutete, sondern ist eine echte *Gonophora,* mit welcher *G. taprobanae* Gestro identisch ist. Das Exemplar meiner Sammlung stammt vom Originalfundorte Kandy.

Gonophora (Micrispa) javana sp. nov.

Ferruginea, subopaca, antennis medio flavis, lateribus postpectoris, ano, scutello, apice et macula laterali pone medium elytrorum nigris; elytris lateribus sinuatis, costa tertia pone medium interrupta.

Long., 3 mm.

Java, Noesa Kambangan, Januar 10, 1913 (*Drescher*).

In der Farbe und Zeichnung an *G. minuta,* in der Körperform mehr an *G. sinuata* erinnernd, kleiner als beide, und von ersterer schon durch die hell gefärbten Beine, von letzterer durch die wenig schwarz gezeichneten Flügeldecken leicht zu unterscheiden.

Gestreckt und schwach gewölbt, rostrot, die Ränder und die Erhöhungen des Halsschildes nebst den Flügeldecken noch heller und mehr gelblich, die Fühler blassgelb, das erste Glied und die drei Endglieder rostrot, Schildchen schwarz, die Seiten der Hinterbrust, das letzte Bauchsegment, die Spitze der Flügeldecken und eine Quermakel davor, vom Seitenrande bis zur zweiten Rippe ausgedehnt, schwärzlich. Stirn glatt, Halsschild annähernd herzförmig, vor der Mitte am breitesten, nach vorn wenig, nach hinten stärker, verengt, die Seiten stark gerundet,

[2] Deutsche ent. Zeitschr. (1904) 457.

hinten leicht eingeschnürt; auf der Scheibe sind wie gewöhnlich zwei Querstreifen stärker vertieft, punktirt, die Mittellinie und ein Höckerchen jederseits davon erhöht und glatt. Schildchen hinten rechteckig, vorn erweitert. Flügeldecken hinter der Schulter deutlich ausgeschweift, hinten wenig verbreitert, die drei Längsrippen auf jeder kräftig, die dritte an der schwarzen Makel unterbrochen, die zweite bis zwei Drittel der Länge weiter von der ersten entfernt als dahinter und durch drei Punktreihen getrennt.

Dactylispa spinosa Weber vergleicht Gestro [3] mit seiner *D. aspera* und rechnet sie zu den Arten mit vier Seitendornen des Halsschildes; sie besitzt jedoch nur drei (2, 1), denn Weber sagt: "Thorax spinis quatuor erectis, acutis, furcatis et duobus lateralibus minoribus simplicibus;" und Fabricius: "Spinis quatuor nigris, lateralibus trifidis, intermediis bifidis." Zur falschen Auffassung dieser kleinen, 4 Millimeter langen, rostroten, auf den Flügeldecken schwarzen Art von Sumatra ist Gestro durch den Vergleich eines Stückes aus dem Brüsseler Museum gekommen, welches von Chapuis ohne Grund für *D. spinosa* gehalten wurde.

Dactylispa flavolimbata, Sarawak, Serambu, Februar, 1913, und *D. malayana,* Sarawak, Banting, Mai 17, 1909 (auch von Herrn Drescher auf Java bei Noesa Kambangan im Juli, 1913 gefangen) sind nahe verwandt und bilden eine Gruppe die sich durch das Schildchen von den übrigen Verwandten absondert.

Bei letzteren bildet dasselbe eine ebene, dicht und sehr zart gewirkte matte Fläche, während es in beiden oben genannten Arten zum grössten Teile von einer glatten ovalen Quergrube eingenommen wird, die vorn nur einen schmalen, jederseits verbreiterten, ebenen, und gewirkten Streifen frei lässt. Die drei Seitendornen des Thorax stehen auf einem gemeinsamen schlanken Stiele, die beiden ersten an der Spitze desselben, der dritte am Hinterrande wenig über der Basis. Der mittelste Dorn ist etwas länger wie die beiden anderen.

Dactylispa drescheri sp. nov.

Testaceo-flava, antennis piceis articulis 5 ultimis ferrugineis, elytris (limbo apicali excepto) nigris, sat nitidis, parce pilosis. Prothorace subopaco lateribus spinis tribus gracilibus, longis, proparte appendiculatis armato, elytris longe nigro-spinosis, spinis apicalibus brevioribus flavis.

Long., 4 mm.

[3] Ann. Mus. Civ. Genova (1897) 86.

Java, Noesa Kambangan (*Drescher*).

In der Färbung an *D. weyersi*, *D. discoidalis* und *D. debilis* erinnernd; von ersterer durch die Farbe der Fühler und die zum Teil mit Anhängseln versehenen Thoraxdornen, von *D. discoidalis* durch die Thoraxscheibe, auf welcher der erhöhte glatte Querstreifen auf eine undeutliche, kleine, ovale Längserhebung in der Mitte beschränkt ist, und von *D. debilis* durch den nicht freien dritten Seitendorn des Halsschildes zu unterscheiden. Gelb, auf Brust, Bauch, und Thorax mit rötlich brauner Beimischung, die Flügeldecken schwarz, an der Spitze gelb gesäumt. Fühler schlank, die ersten sechs Glieder pechschwarz, die etwas verdickten fünf Endglieder dunkel rostrot; Glied 1 stark, 2 wenig schmaler, kurz, eiförmig, die folgenden vier dünn, 3 wenigstens so lang als 1, die drei folgenden kürzer. Die Dornen der Oberseite sind verhältnismässig lang, schlank. Der zweite Vorderranddorn des Thorax steht nicht ganz senkrecht, sondern ist schwach nach vorn geneigt und hat über der Mitte ein nach vorn gerichtetes Dörnchen. Von den drei Seitendornen ist der mittlere der längste, mit zwei Dörnchen versehen, und hat mit dem ersten einen gemeinschaftlichen Basalstiel, an dessen Basis auch der dritte entspringt. Dieser ist etwas kürzer als der zweite, aber etwas länger als der dritte Dorn; alle sind schwarz, an der äussersten Basis rötlich. Die Thoraxscheibe ist ziemlich matt, dicht verloschen und flach punktirt, mit zwei deutlichen Quer- und zwei unbestimmten Längseindrücken, durch die ein verloschener, kleiner, kaum punktirter Raum in der Mitte emporgehoben wird. Die Flügeldecken sind gereiht-punktirt (in jedem Punkte ein feines, aufgerichtetes greises Härchen) und haben ausser einigen kurzen Dornen nahe der Basis und dicht vor dem Hinterrande noch je ungefähr dreizehn lange Dornen, während der Seitenrand mit acht oder neun langen schwarzen Dornen besetzt ist. Am Hinterrande befinden sich je vier oder fünf kürzere rötlich-gelbe Dornen, von denen ein grösserer mit einem kleinen abwechselt.

Dactylispa secura sp. nov.

Nigra, elytris metallico-splendentibus, antennis longis, gracilibus, apice rufescentibus, prothorace creberrime punctato opaco, ante basin late transversim impresso, lateribus medio dilatato et bispinoso, elytris sat fortiter striato-punctatis, humeris bi-, dorso decem-lateribusque sex- vel septem-spinosis.

Long., 4 ad 5 mm.

Madagaskar, Mahatsinjo bei Tananarive (*Donckier*).

Von ähnlicher Gestalt als *D. dichroa,* aber kleiner und durch die nur zweidornigen Halsschildseiten ausgezeichnet. Schwarz; Stirn, Thorax, und Schildchen matt, die Flügeldecken glänzend, mit einem blassen Messingschimmer überzogen, die fünf letzten Fühlerglieder rotbraun. Stirn zum spiegelblanken Halse plötzlich abfallend. Fühler schlank, länger wie der halbe Körper; Glied 1 und 3 lang, 2 kurz, 4 und 5 etwas kürzer als 3, 6 und 7 jedes wenig kürzer als 4, das siebente nebst den folgenden Gliedern verdickt, 8 bis 10 kurz, jedes so lang als 2, das Endglied nur wenig länger. Thorax stark quer, die Seiten nach der Mitte hin winkelig erweitert; diese Erweiterung läuft in einen kurzen Stiel aus auf dem zwei mässig lange, wenig schräg, nach aussen gerichtete Dornen stehen. Unbedeutend länger ist der hintere, senkrechte Vorderranddorn, der vordere, der sich in sehr spitzem Winkel trennt, ist etwa halb so lang. Die Scheibe ist sehr dicht und etwas narbig punktirt und hat zwei Quervertiefungen, eine schwache und schmale hinter den Vorderranddornen und eine stärkere vor dem Hinterrande; zwischen beiden liegt ein undeutlicher Querwulst, nach innen zu einer glatten Mittellinie abfallend. Die Flügeldecken sind stark gereiht-punktirt, mit schlanken Dornen, von denen die mittleren viel länger als die an der Basis und Spitze stehenden sind. Ausser einigen Basaldörnchen befinden sich auf der Schulterbeule zwei Dornen, der erste kurz, der zweite lang; auf dem ersten primären Zwischenstreifen fünf (die drei mittleren lang), auf dem zweiten einer, hinter der Mitte, auf dem dritten vier Dornen, während die Seiten mit sechs oder sieben Dornen bewehrt sind. Von diesen sind der letzte oder die beiden letzten am Hinterrande sehr kurz.

Dactylispa aeneipennis Duviv.

Schwarz, Flügeldecken mit Bronceschimmer; ist dadurch ausgezeichnet dass die wenigen Dornen der Flügeldecken nur auf den äusseren zwei Drittel stehen, nämlich drei auf der Schulter (der erste kurz, der zweite mässig hoch, der dritte lang), und vier noch etwas längere (1, 1, 2) dahinter: der erste dicht hinter ein Viertel der Länge, der zweite dicht hinter der Mitte, beide zwischen der vierten und siebenten Punktreihe, die andern zwei vor der Spitze, einer an der hinteren Aussenecke, der andere zwischen der zweiten und vierten Punktreihe. Am Seitenrande befinden sich zwei lange Dornen, genau wie die beiden ersten Scheibendornen gestellt, am Hinterrande zwei Dörnchen.

Madagaskar, Mahatsinjo (*Donckier*).

Dactylispa excisa Kraatz var. repanda var. nov.

Von Kiautschau erhielt ich durch Staudinger eine *Dactylispa*, die eine Varietät von *D. excisa* bilden dürfte, auf welche ich durch den Namen *repanda* aufmerksam mache. Sie ist nur 4 Millimeter lang, schwarz, Fühler, Beine, und Bauch gelb, die Dornen des Halsschildes und drei Dornen im Ausschnitte der Flügeldecken etwas dunkler, rötlich gelb, die Scheibe der Flügeldecken mit Ausnahme der darauf stehenden Dornen glänzend rötlich pechbraun. Der vordere Dorn am Vorderrande des Thorax hat an der Basis ein dornförmiges Anhängsel, das kaum ein Drittel so lang ist wie der Dorn selbst, während der Seitenlappen nicht fünf, sondern nur vier Dornen trägt: drei längere, die auf einer gemeinsamen breiten Basis dicht hinter einander entspringen und einen weiter abgerückten, kürzeren dahinter.

Dactylispa adstricta sp. nov.

Piceo-nigra, opaca, antennis, pedibus ventreque rufo-flavis, prothorace creberrime subvarioloso-punctato et parce brevissimeque griseo-piloso, plagis tribus elevatis, glabris, alutaceis transversim positis, antice utrinque spinis duabus crassis verticalibus, longitudinaliter dispositis et basi alte connexis, lateribus spinis tribus rufo-flavis (1, 1, 1) armatis, elytris acute tuberculatis, crista humerali et lateribus (his paullo ante medium coarctatis) breviter spinulosis.

Long., 5 mm.

Japan, Harima (*Staudinger*).

Vor der Mitte stimmt diese Art im Körperbaue völlig mit der vorigen überein, hinter der Einschnürung aber erweitern sich die Flügeldecken nur ganz allmählich nach hinten; ausserdem sind die Fühler kürzer und dicker, und die ganze Oberseite ist matt pechschwarz, zart gewirkt oder gerunzelt, matt; Fühler, Beine, und Bauch lebhaft rötlich gelb, die mittleren Fühlerglieder 3 bis 6 mehr gelb, die drei Seitendornen des Halsschildes nebst dem langen und schmalen Lappen auf dem sie hinter einander stehen dunkler rötlich gelb. Fühler kurz, bis zur Schulter reichend; die fünf Endglieder bilden eine sehr schlanke Keule, an der die Glieder 8 bis 10 breiter wie lang sind. Stirn gerunzelt, ein vertiefter Streifen neben jedem Auge weisslich behaart. Halsschild um die Hälfte breiter als lang, dicht punktirt, in der Mitte mit einer Querreihe von drei gerundeten, erhöhten und nur zart gewirkten Flecken. Die beiden Dornen jederseits am Vorderrande sind schwarz, kurz, breit, senkrecht

hinter einander auf einer hohen Längsleiste eingefügt, der erste hat in der Mitte des Vorderrandes eine kleine zahnförmige Erweiterung und ist etwas niedriger als der zweite; die drei Seitendornen sind etwas schlanker aber kaum länger, schräg nach aussen gerichtet, und stehen ebenfalls auf einer gemeinsamen Längsleiste. Die Flügeldecken treten an der Basis gradlinig heraus, sind in den Schultern bedeutend breiter wie der Thorax und erweitern sich dahinter bogenförmig in einen Lappen, der einem Kreissegmente ähnelt und kurz vor der Mitte endet, von hier aus erweitern sie sich allmählich nach hinten und sind am Ende breit und fast gemeinschaftlich abgerundet. Die Seiten sind kurz, vor der Mitte dicht, dahinter weitläufiger, und an der Spitze dicht und sehr kurz-gezähnt, die Schulter bildet eine Leiste, die mit fünf oder sechs Zähnchen bewehrt ist. Die Scheibe hat eine Anzahl kürzer und dicker zahnförmiger Erhebungen. Von diesen liegen vier auf der ersten, nur angedeuteten primären Rippe, nähmlich ein sehr kleiner Zahn nahe dem Schildchen, ein grosser vor und hinter der Mitte, und ein kleiner vor der Spitze. Die zweite Rippe hat zwei grössere Zähne, in und hinter der Mitte; neben dem letzteren steht ein ähnlicher Zahn auf der dritten Rippe, welche vorn noch einige unbedeutende Erhebungen hat.

Dactylispa aspera ab. **matangensis** ab. nov.

Der Thorax ist etwas stärker punktirt als bei der Stammform von Sumatra (die Punkte annähernd narbig, von einem erhöhten Rande umgeben) und die Flügeldecken sind einfarbig schwarz, vorn nicht rostrot. Ausser dem vorderen Dorne am Vorderrande des Halsschildes kann auch der hintere ein dornförmiges Anhängsel haben, oder beide sind einfach. Am Seitenrande stehen auf einem gemeinschaftlichen Stiele vier Dornen, die drei ersten unter sich gleich lang, der vierte viel kürzer und schräg nach hinten gerichtet.

Sarawak, Matang und Oya, August, 1910.

Von *Dactylispa longicuspis* Gestro befindet sich ein Stück im Sarawak Museum (Mount Poi, 3000 bis 3500 Fuss, April 17, 1913), mit einfarbig schwarzen Flügeldecken. Die Art ist durch die auffällig langen, mit variablen Anhängseln versehenen drei Thoraxdornen kenntlich, von denen die beiden ersten aus einem sehr langen gemeinsamen Stiele entspringen, an dessen Basis der kurze und einfache dritte Dorn befestigt ist.

Dactylispa fulvicornis sp. nov.

Fulva, elytris nigris, sat nitidis, antennis elongatis, articulo tertio longissimo, prothorace crebre punctato et breviter albopiloso, vitta media abbreviata sublaevi, lateribus bispinosis, spinis basi conjunctis, antica appendiculata, postica multo breviore, elytris spinis numerosis sat longis armatis.

Long., 5 mm.

Borneo, Sarawak, Lawas, August, 1909.

An der Bewehrung des Halsschildes kenntlich. Der hintere senkrechte Vorderranddorn ist doppelt so lang wie der vordere; an den Seiten stehen nur zwei Dornen: der erste ist fast eben so lang als der zweite Vorderranddorn, aber etwas stärker und mit mehreren Dörnchen besetzt, an seiner Basis entspringt der zweite, kurze, einfache, und schräg nach hinten gerichtete Dorn. Der Körper ist ziemlich gestreckt, rötlich gelb oder hell rostrot, die Flügeldecken schwarz, ihr abgesetzter Seitenrand an der Spitze etwas verbreitert, und nebst den dort befindlichen kurzen Dornen rötlich gefärbt. Fühler schlank, etwas länger wie der halbe Körper, ihr drittes Glied so lang wie die beiden ersten zusammen. Thorax dicht punktirt und zart weisslich behaart, matt, ein gewölbtes, beiderseits abgekürztes Querband in der Mitte fast glatt und glänzend. Flügeldecken mit zahlreichen schlanken Dornen besetzt, von denen der zweite in der ersten Reihe der längste ist, an den Seiten wechselt ein langer und ein kurzer Dorn ab, von zwei Drittel der Länge bis zur Nahtecke werden die Dornen allmählich kürzer.

Dactylispa rufiventris Kraatz.

Eine Reihe von Exemplaren vom Kamerunberge, Soppo, 730 m. (*v. Rothkirch* 1912) in den Vorräten Staudingers hat den Bauch einfarbig tief schwarz. Sonach trifft die Bemerkung von Kraatz,[4] "die Art ist an ihrer Grösse und dem roten Hinterleibe sehr leicht zu erkennen," nicht immer zu, und ich mache auf diese abweichende Form durch den Namen *D. nigriventris* aufmerksam. Die Art zeichnet sich durch das Halsschild aus. Die drei Seitendornen desselben, von denen der mittelste der längste, der dritte der kürzeste ist, sind von einander deutlich getrennt oder an der Basis nur genähert, und die glänzende Scheibe ist sparsam punktirt. Die Punkte sind gross und flach, narbig, stehen dichter in dem weiten, an den Seiten nach vorn

[4] Deutsche ent. Zeitschr. (1895) 197.

gebogenen Quereindrucke vor der Basis, während sie in dem vorderen Quereindrucke eine oder zwei unregelmässige Längsreihen bilden. Die Länge der Art schwankt zwischen 5 und 7 Millimeter; Gyllenhal[5] hat sie, als var. β seiner *Hispa spinulosa* betrachtet.

Hispa comata sp. nov.

Testacea, opaca, supra griseo-pubescens, prothorace ramulo elongato duodecim spinoso lateraliter armato, elytris striato-punctatis dense spinulatis, in disco spinulis, crassioribus subinfuscatis et gracilibus dilutioribus alternantibus.

Long., 3 mm.

Syria, Aleppo (*Staudinger*).

Einer kleinen *H. pavida* ähnlich. Rötlich gelbbraun, matt, auf dem Halsschilde sehr dicht, auf den Flügeldecken sparsamer weisslich behaart. Fühler ziemlich kurz, schwärzlich, Glied 2 kaum schwächer aber nur halb so lang as 1, 3 dünner und unbedeutend kürzer als 2, 4 und 5 kürzer als 3, 6 das kleinste, die folgenden Glieder verdickt, 7 so lang als 2, 8 bis 10 jedes kürzer. Der Thorax erweitert sich an den Seiten in einen langen und schmalen Lappen, welcher mit zwölf langen, feinen Dornen besetzt ist. Von diesen steht einer in der Mitte an der Basis und ist schräg nach vorn und innen gerichtet, die übrigen bekränzen die Seiten und liegen fast horizontal; die beiden letzten sind bedeutend kürzer wie die vorhergehenden. Wenn der letzte gespalten ist, was zuweilen und dann meist nur einseitig vorkommt, kann man dreizehn Dornen zählen. Die Punktirung des Halsschildes wird von der dichten Behaarung verdeckt. Die Flügeldecken sind gereiht-punktirt und ziemlich dicht bedornt. Die Dornen des Randes sind schlank, am Hinterrande verkürzt, die der Scheibe bestehen aus stärkeren, dunkler gefärbten, und etwas kürzeren, viel dünneren hellen Dornen.

Platypria moluccana sp. nov.

Ferrugineo-flava, elytris glabris, nitidulis, nigris (basi excepta), margine bilobatis, lobo antico sexspinoso, postico trispinoso.

Long., 5 mm.

Batchian, August, 1906 (*Koller*).

In der Körperform, Grösse, und Farbe am meisten mit *P. dimidiata* übereinstimmend, aber der Thoraxlappen bedeutend

[5] Schönh. Syn. Ins. App. (1817) 3.

breiter, kürzer bedornt, und der vordere Seitenlappen der Flügeldecken mit sechs, der hintere mit drei Dornen besetzt. Durch diese Bewehrung tritt die Art näher an *P. echidna* und *P. squalida* heran, weicht jedoch von ersterer durch das einfarbige Halsschild und die dunkle Flügeldecken, von *P. squalida* durch unbehaarte und mässig glänzende Flügeldecken ab.

Körper rötlich gelb, die Flügeldecken schwarz, eine Basalbinde der letzteren, ein feiner Saum zwischen den Seitenlappen und in der Spitze nebst dem matten, stellenweise dicht und sehr fein punktirten Halsschilde blass rostrot. Die Basalbinde reicht bis an die beiden ersten Scheibendornen und an den Anfang des Seitenlappens, von dem der erste Dorn und die innere sehr grosse Pore ebenfalls hell gefärbt ist, verlängert sich aber innen saumförmig auf der Naht bis an den zweiten Dorn der ersten primären Rippe. Die Fühler sind schlank, normal gebaut. Der Seitenlappen des Thorax ist halboval, schwach glänzend, mit fünf Dornen besetzt, von denen die ersten vier ziemlich lang sind, während der fünfte klein und kaum länger aber stärker als der vorn befestigte Borstenkegel ist. Die Flügeldecken besitzen am Basalrande zwei Dörnchen, auf der Schulter drei ziemlich kurze, auf der Scheibe sechs dicke und lange Dornen (2, 2, 1, 1), wovon die ersten beiden und der letzte Dorn (neben der hinteren Aussenecke) kürzer wie die übrigen sind.

MERRILLOSPHAERA, A NEW GENUS OF THE VOLVOCACEAE

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EIGHT PLATES AND ONE TEXT FIGURE

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INTRODUCTION

In 1859, Carter described what he supposed to be *Volvox globator* Ehrenberg, which he found in India, presumably in the neighborhood of Bombay. From Carter's description, Stein ('78, p. 134) recognized the plant as specifically distinct from all that had been described, and he named it *Volvox carteri*. Stein improperly regarded it as intermediate between the species *V. globator* and *V. aureus* of Ehrenberg, whereas in reality it is neither intermediate between those species nor even so closely related to either of them as they are to each other.

One of the several members of the subfamily Volvoceae which I have collected at Manila so nearly fits Carter's description that I shall treat it here as a mere variety. Yet this species differs so much from the earlier described species of *Volvox* that I shall assign it, with others, to a new genus. Carter noted the absence of protoplasmic connecting filaments between the somatic or vegetative protoplasts. There had long been in my mind a question as to the propriety of including in the genus

Volvox organisms so different from *V. globator* and *V. aureus* as to lack the intercellular protoplasmic connecting filaments. The question was answered for me by the early differentiation and large size of the asexual reproductive cells of this and of a related species. Carter described the asexual reproductive cells, the gonidia, as reaching a large size before undergoing segmentation. His figure of a gonidium ('59, pl. 1, fig. 4), which is reproduced on a larger scale in Plate 7, fig. 44, shows one that had reached a diameter of 85 μ. However, he did not appreciate the fact that such large gonidia, prominent in the daughter coenobia long before birth (as shown in his fig. 1, reproduced in Plate 7, fig. 42), are differentiated from the somatogenic cells (those which by division produce the somatic or vegetative cells) at a very early stage in the development of the embryo and remain large, while the somatogenic cells become smaller and smaller by the repeated divisions which produce the very numerous somatic cells.

Carter's account of the asexual reproduction seems to have been based on observations which failed to include the stages that commonly occur at night. Until I had made a few observations on living material through the hours of the night, my own work was in a fair way to muddle up in a description of one "species" forms that I now consider generically distinct. One of these forms I have already described under the name *Campbellosphaera obversa* (Shaw, '19). Its most distinctive character is a migration of the gonidia during the bowl stage of the embryo from the outside to the inside through the opening, or phialopore, just before the closure which converts the bowl-shaped embryo into a closed globular colony, or coenobium. The absence of such a migration is the important character that was revealed by the nocturnal study of the species which forms the subject of this paper.

Taking as a basis the characters found in the material in hand, I propose a new genus, **Merrillosphaera**, dedicated to Elmer Drew Merrill, the most indefatigable investigator of the flora of the Philippine Islands and the Indo-Malayan region. Believing this material cospecific with *Volvox carteri* Stein, I shall call it **Merrillosphaera carteri** (Stein) comb. nov. with the designation **manilana** for the form or variety first to be described in sufficiently full detail to furnish a basis for the recognition of the proper status of the genus. A very similar form was described by Powers ('08) under the name *Volvox weismannia*. It is both proper and convenient to reduce this to **Merrillosphaera carteri** *var.* **weis-**

mannia (Powers) comb. nov. Less fully described is a form collected and prepared by Migula, and called by Klein ('89B) *Volvox aureus*. This evidently is not the *Volvox aureus* Ehrenberg described by Klein ('89A and '90) but is a new species similar to *M. carteri* which I call Merrillosphaera migulae sp. nov.

Of another species of *Volvox*, one described by West ('10 and '18) under the name *V. africanus*, my Philippine material contains stages which fill out the life history and show its affinity with the species and varieties listed in the foregoing paragraph. It therefore becomes Merrillosphaera africana (West) comb. nov. (*Volvox africanus* West).

A third species of *Volvox*, described by Meyer ('96) under the name *V. tertius*, seems to fit into the new genus more readily than into any other, and this may be sufficient reason for classifying it tentatively as Merrillosphaera tertia (Meyer) comb. nov. (*Volvox tertius* Meyer). Of this species we have as yet only Meyer's description, which is in many respects very meager.

All of these species are characterized by having rounded somatic protoplasts without connecting filaments, and also by having gonidia which are differentiated at an early embryonic stage. To this extent they agree with *Campbellosphaera*, but they differ from the latter in lacking the migration of the gonidia through the phialopore into the coenobium. Two other species that lack interprotoplastic filaments develop their gonidia only after birth, and these I had previously assigned to two genera. Those with a reproductive area in which a small number of the cells develop into gonidia were put in the genus *Besseyosphaera* (Shaw, '16), while those with a reproductive area in which all of the cells develop into gonidia were put in the genus *Pleodorina* (Shaw, '94).

In presenting the descriptive details pertaining to the species and varieties of *Merrillosphaera* I shall begin with the descriptions of a series of specimens, selected primarily from those which have been photographed and that are supposed to represent the life history of *M. carteri* var. *manilana*, of which the first will constitute the type of the variety. Then the nearly related varieties of the literature will be taken up separately and described with the same terminology, for comparison with the variety in hand.

In another paper I purpose to extend our knowledge of *Merrillosphaera africana* (West) Shaw by means of descriptions of specimens in my collections.

Two species of *Volvox* proper that occur in my Philippine material more or less mixed with species of the related genera I have described in another paper (Shaw, '22) in which a special genus was made for the European species long known as *V. aureus* Ehrenberg.

MERRILLOSPHAERA CARTERI VAR. MANILANA VAR. NOV.

DESCRIPTION OF THE TYPE SPECIMEN

For the type of this variety, an asexual specimen (Plate 1, figs. 1 and 2) has been selected in order to exhibit a character which is essential to distinguish the genus from *Campbellosphaera*. This character appears in embryos that are in a stage which makes it fairly plain that the gonidia are differentiated early, but do not migrate.

The specimen (No. 1) is one of a batch collected from Pond C in Pasay, near the southern outskirts of Manila, September 20, 1914, and fixed at some time on the next day in picronigrosin. Material from this batch was mounted in glycerine on several slides and sealed with shellac. Slide 4 of this lot bears the specimen under a cover glass with glass rodlets measuring 309 to 354 μ, which were distributed for cover supports but are loose and now clustered at one side of the circle. The glycerine is strongly colored with picric acid. There is no record of the time when the mounts were made, but the photographs were taken June 13, 1916. So they were at the time of making measurements (July, 1919) more than three years old. The mount had then taken up no air bubble,[1] but the paper label of the slide showed glycerine on the edge nearest the cover, which raised a suspicion as to the security of the sealing. The slide bears a mixture of several species of Volvoceae. There are numerous hyphae extending into and through the glycerine; they appear to have developed in it.

The type specimen measures 545 by 590 μ. The upper and lower sides are seen with a difference of focal adjustment amounting to about 250 μ, which, with an allowance of 1.4 for the optical density of the glycerine, gives an estimated thickness for the specimen of about 350 μ. The area of the somatic surface that is flattened by the cover glass is about 350 by 400 μ in extent. Within this area the somatic protoplasts of the

[1] The specimen has since been ruined, partly by escape of glycerine and formation of a large bubble, and partly by destructive movement of glass rodlets.

somatic wall are somewhat crowded and average about 9.5 μ between centers. Just outside of the flattened area the distance between cells is about 10 μ. This, with an approximate mean diameter taken as 560 μ, gives 11,400 as the number of cells. The protoplasts are somewhat farther apart in the anterior polar region.

The somatic protoplasts are globose or oval, without connecting filaments. They are about 5.4 μ thick. Their distance from the outer membranous surface of the soma is about half a protoplastidar diameter or less. The outer surface appears quite even. The middle lamella between the protoplasts cannot be seen, nor is the inner limit of the cell membranes visible.

Eight embryos are contained in the coenobium,[2] occupying positions in the coenobial cavity near the coenobium wall, four just ahead of the equatorial plane and the four others alternating with them just back of that plane. The embryos are very darkly stained. They have developed into many-celled coenobia, in the walls of which gonidia may be seen embedded and protruding. Six of the embryos can be seen to contain small numbers of reproductive cells. Two of them are not so clear. The one which is shown in Plate 1, fig. 2, is about 90 μ in diameter; it has somatogenic cells of about 2.5 μ width, and contains four cells of about 8 μ diameter (which are not visible in the figure), grouped closely about what I take to be the site of the phialopore. It also contains eight cells about 17 μ in diameter, obviously gonidia, distributed in the coenobium wall—five near the median plane (two of which stand out clearly in the figure), one on the nearer side, and two on the farther side.

A well-marked feature of the embryos is that their gonidia are embedded in the layer of somatic cells where they are formed. Being more or less nearly isodiametric, and larger than the cells of the somatic layer, they protrude beyond the surface of the coenobium.

ASEXUAL COTYPE SPECIMENS

On the type slide are four other specimens of the same species, containing embryos in the same stage as those in the type specimen, or slightly younger. With them are twelve asexual coenobia with gonidia and two sexual coenobia with young

[2] The use of the term "coenobium" for the bodies of these organisms is not consistent with my view that they are properly to be regarded as individuals rather than as colonies.

oogonia. I will describe some of these specimens in order to bring out points that are not shown by the type specimen.

Specimen 2.—This coenobium contains eight embryos and presents an almost polar anterior view. Diameter, about 505 μ; thickness, about 365 μ; protoplasts, about 5 μ. Spacing of centers of cells: Anterior, about 20 μ; posterior, about 12 μ; and mean, about 15 μ. Estimate of somatic cells, 4,100. In the median focus there is seen a delicate line nearly parallel with the periphery of the optical section of the coenobium, forming an ellipse 280 by 300 μ in diameter, lying 110 to 120 μ within the outer membrane. The eight embryos lie in the zone between this line and the layer of somatic cells. These embryos are about 90 μ in diameter, and those that show clearly near the median level and above it have their phialopores directed outward. Around each embryo there are two distinct lines; these are the inner and outer limits of an embryo capsule which was formed by the wall of the gonidium from which the embryo developed. The embryo capsule touches the embryo on the side toward the center of the mother coenobium, is about 10 to 15 μ from the surface of the embryo around the equatorial plane of the embryo, and approaches without touching the embryo on the outer side. Around the equatorial region of each embryo its capsule is about 30 μ thick, while toward the poles it thins down until at the poles it becomes very thin, as if under radial pressure between a central coenobial core and the somatic layer of the mother coenobium. All the embryos show a few protruding gonidia, and these are most evident in the profile views of the embryos. The somatic cells are very much smaller than the gonidia. The embryonic phialopores are all more or less open and have the form of a four-pointed star. This is produced by the growth about the phialopores of four marginal lobes which for a time do not fit together, but which leave the star-shaped opening between them. The extent of the star is about one quarter of the circumference of the embryo. In some of the embryos the lobes are slightly raised and bent outward and bear on their tips one or more larger cells that are intermediate in size between the gonidia and the somatic cells. The embryos are so far apart that their capsules are not in contact with one another.

Specimen 3.—This coenobium contains eight embryos. It presents a side view, with the anterior pole a little lower than the posterior pole. Dimensions, 560 by 600 μ. Spacing of cells:

Anterior, 20 μ; equatorial, 13 μ; posterior, 15 μ; mean, about 15 μ. Estimated number of cells, 5,300. Somatic protoplasts, about 5 to 6 μ. A thick middle lamella of the somatic cells shows in a surface view, even under the low power. The embryos, about 90 μ, are closed or closing. The phialopores are directed outward, and a side view of one embryo shows the lobes around the stellate opening bent outward and tipped with large cells. The inner ellipsoidal membrane, or core boundary, of the coenobium is 330 by 358 μ, the zone between it and the outer limit of the coenobium being 115 μ in front and 130 μ behind. The inner lamella of the embryo capsule delimits the space about each embryo, but the outer lamella does not show.

Specimen 4.—An asexual coenobium with eight embryos, 565 by 593 μ. Spacing of cells: Anterior, 20 μ; equatorial, 15 μ; posterior, 13 μ; estimated mean, 15 μ. Number, 5,300. Embryos 85 to 95 μ, closing and closed, with gonidia protruding beyond the surface. Lobes about the phialopore bent outward in one embryo and bearing larger cells. Only the inner lamella of the embryo capsules is visible.

Specimen 5.—An asexual coenobium with six embryos and four gonidia. Oblique view. 562 by 590 μ. Spacing of cells, 10 to 13 (mean 11) μ. Number, 9,800. Embryos about 80 μ each, with protruding gonidia. Two of the gonidia of the parent, each about 64 μ in diameter, form a posterior pair; while the two others, with diameters of 68 and 70 μ, respectively, form a subposterior pair.

FEMALE COENOBIA

An asexual coenobium (specimen 6) with eight female daughters, which are distributed like the embryos in the type specimen, is shown in Plate 1, fig. 3. This specimen is of the same collection as the type specimen, but of a batch fixed one day later; that is, two days after collection. It is in a picro-nigrosin preparation mounted in glycerine; it was photographed in 1916, and was still in good condition in 1919. The coenobium measures 590 by 643 μ. The thickness of the specimen measured about 250 μ. Near by is a glass rodlet 265 μ thick, which was used to support the cover glass. The somatic protoplasts are about 5.3 to 5.9 μ wide. Their intercentral distances respectively are approximately these: Anterior, 21 μ; equatorial, 14 μ; posterior, 17 μ; and mean, considering the relative extent of the different areas, 16 μ. This gives the estimate of the number of cells, 5,250. The daughters all contain reproductive cells, which are more numerous and smaller than gonidia would be at

the same stage. They are the female reproductive cells. One daughter, the second from the left in the upper row, measures 178 by 180 μ. The somatic protoplast diameters are about 3.6 μ; the intercentral distances, about 4.9 μ; and the estimated number of cells, 4,850. The oogonia are about 15 μ in diameter, number about 24, and are distributed just under the somatic layer in all except the anterior quarter of the daughter, this quarter being at a higher level than the picture plane. Over each oogonium there is a vacancy in the layer of somatic cells, this space being surrounded by seven or eight somatic cells. Each of the other daughters shows an area lacking reproductive cells, and all the daughters have nearly the same dimensions and about the same number of somatic cells and reproductive cells. The smallest is 145 by 150 μ, the largest 175 by 190 μ. The oogonia were counted and measured in three other daughters which are above the median plane. The counts are 27, 37, and 31, and the measurements 13, 15 (exceptionally 11 and 16), and 14 μ, respectively. The smallest oogonia are a few of those in the coenobium that contains the largest number. The oogonia are vacuolate protoplasts, each with a central nucleus and with parietal chromatophores. No membranes can be seen except the outer limiting membranes of the mother and of the daughters. The position of the inner lamella of the embryo capsules seems to be marked by confinement of the cilia of the daughters to a space having a width that is much less than the length of the cilia.

A nearly mature female coenobium (specimen 7) from slide 1 of the type lot is shown in Plate 1, fig. 4. This specimen measures 264 by 380 μ, and has a thickness, in its compressed condition under the cover glass, of about 186 μ. The somatic protoplasts are 4.4 to 5.3 μ wide, and the distances between their centers are, approximately: Anterior, 12.5 μ; equatorial, 10 μ; posterior, 9 μ; and mean, about 10.2 μ. The estimated number of somatic cells is 4,850. Distributed in about three quarters of the coenobium, and located about 25 μ below the outer surface, there are twenty-nine reproductive cells, of which five have thickened walls which mark them as oospores. These oogonia are mostly about 27 μ in diameter, two exceptional ones near the posterior pole measuring 22 and 25 μ, respectively. Over each reproductive cell there is a vacancy in the layer of somatic cells, each such space being surrounded by about six somatic cells. In the reproductive region, and anterior to the equator, there are discernible five vacancies in the somatic layer without corresponding reproductive cells. These may be the

sites of antheridia, but I do not think it likely. The oospore walls are not very strongly developed. They measure about 32 μ across, except one containing a protoplast which appears to be pathologically plasmolized into a bowl shape, and this wall measures 35.6 μ. These walls are smooth, and concentric with the protoplast, except one which is eccentric.

A more-mature female coenobium, one containing nearly ripe oospores, is shown in Plate 4, fig. 24. This specimen (No. 8) is in a collection taken from Pond I, less than a hundred yards from Pond C, in Pasay, October 5, 1914. It is on slide 1 of a lot of picro-nigrosin glycerine preparations made from the same collection. The cover glass is supported only by a shellac ring and has flattened the large coenobia, reducing their thickness to about 112 μ. The cleft in the forward pole is a result of the cover-glass pressure. Measurements of coenobia in such a flattened condition are not very satisfactory, and those made of this one in 1921 do not accord with the dimensions of the photograph. The specimen now measures about 693 μ wide and 737 μ long. The average spacing of the protoplasts is about 13.3 μ, and the number of cells is estimated to be between 6,000 and 8,000. The protoplasts are about 6 by 7 μ in diameter. There are thirty-six mature oospores, and there are two unmatured reproductive cells with them. The two dark bodies in the anterior circumpolar region are a green endophyte like a *Chlorosphaera*. The oospore walls shown in Plate 4, fig. 29, have a very slightly wavy appearance that is more pronounced in direct view of some spores. They measure in outside diameter about 50 μ, appear to be about 2.5 to 3 μ thick, and contain protoplasts that are mostly about 39 μ thick and in contact with the wall at one side and therefore eccentric.

MALE COENOBIA

A mature asexual coenobium containing male and asexual progeny is shown in Plate 1, fig. 5. This specimen (No. 9) is on the same slide as the female coenobium described in the preceding paragraph. This mother coenobium is turned away from the observer approximately 22°. On the farther side of the coenobium there is in the somatic layer a cleft about large enough for the birth of an offspring. If one of the progeny passed through that cleft it was the member of the anterior quartet located on the farther side. There remain in the anterior quartet an asexual and two male coenobia, and the pos-

terior quartet consists of three asexual and one male coenobia. Within the mother coenobium, near the cleft, there is an anomalous object consisting of an irregularly shaped and bent sheet of hundreds of small cells. It is like a piece torn out of the somatic layer of one of the asexual offspring, but the cells are much smaller. The mother coenobium in its flattened condition measured, in 1919, about 678 by 685 μ. The corresponding dimensions of the photomicrograph are 650 and 660 μ, which indicates that three years of drying have brought the cover glass closer to the slide and squeezed the large specimens flatter, thus making them wider. The specimen measured about 112 μ in thickness. The somatic protoplasts are about 6 to 7.1 μ thick. The outer walls of the somatic cells are slightly convex, especially around the anterior pole, giving the surface of the coenobium a wavy appearance in optical section. The spacing of the somatic cells is about as follows: Forward, 22 μ; in the middle, 17 μ; at the back, 18 μ; average, about 17.5 μ. The consequent estimate of somatic cells is 5,480.[3] Each asexual daughter contains eight gonidia, and over each gonidium there is a vacant place in the layer of somatic cells. The daughter nearest the middle of the picture is 210 μ wide and 230 μ long. Its somatic protoplasts are about 3.6 μ wide, and their centers are about 4.1 μ apart. The number of cells indicated by these figures is 10,100.[3] The gonidia are about 30 μ in diameter. There are pressure creases in the coenobium walls of two of the daughters. Of the male offspring, the lower is 240 by 280 μ, the right one 240 by 290 μ, and the upper one 260 by 270 μ. The last of these has somatic protoplasts about 5.3 to 5.4 μ thick and spaced 10 μ between centers. The estimate of somatic cells is 2,500.[3] Scattered throughout the periphery of the coenobial cavity are 112 or more androgonidia, the cells which produce, by dividing, the bundles or platelets of sperms, mostly with one or two of the segmentation divisions accomplished. A few undivided ones are 10, 14, and 16 μ wide. Those in the 2-celled stage are mostly about 17 by 19 μ, and those in the 4-celled stage about 19 μ each way. The counting of the androgonidia was done by making a camera lucida sketch, in which difficulty was experienced due to overlapping of the progeny in their flattened condition. The number is evidently about the same in all, and is in the neighborhood of 120.

[3] The estimate is probably much too high on account of the flattening of the coenobium.

A free male coenobium (specimen 10) in the same collection as the type specimen is shown in Plate 1, fig. 7. After it was photographed the specimen became crushed between two glass rodlets so that the antheridia cannot be counted. The somatic protoplasts are about 4.5 to 5 μ wide and spaced about 12 μ. The diameter of the coenobium being about 253 μ, the number of the somatic cells is about 1,600. The reproductive bodies are all sperm platelets that are more or less cupped and measure 14 to 19 μ in diameter. They are too darkly stained to admit of counting the sperms. The specimen shows plainly the cilia of the somatic cells and of the sperms. Each sperm platelet is contained in a cavity about 46 μ in diameter.

Two free male coenobia that appear to belong to the same species are in company with the specimen shown in Plate 1, fig. 5. They are very similar to the males within this mother. These two specimens (Nos. 11 and 12) are 295 by 316 μ and 316 by 324 μ in diameter and have about 1,700 and 1,800 cells. The somatic protoplasts are about 7 μ in diameter and measure about 23 μ wide. The antheridia number about 200 in each coenobium and are distributed without leaving a well-marked vegetative pole. They are mostly in the 16-celled stage of division, though some have divided only once or twice. On the same slide with them there is a larger male coenobium that I take to be of another species. It is larger, 390 by 413 μ, and has smaller cells, 6 μ, that are more numerous, about 2,900. The antheridia also are smaller, 18 μ, and more numerous, about 640. This coenobium has no vegetative pole marked by absence of reproductive cells, but the posterior half is narrowed slightly as is commonly the case in *Merrillosphaera africana*.

FORMS OF ASEXUAL COENOBIA

The photomicrographs used for illustrating this paper have been selected from about one hundred fifty that were made to serve as an aid in the task of separating the five or six species of larger Volvocaceae that occurred in various mixtures in the collections made in the neighborhood of Manila. This was done at a time when the number of species and genera was not known. The selection of material was based largely on suitability of the specimens for photography. A result of thus working simultaneously with a number of species is that no one species was followed as far through its range of variation as might have been done had it been studied alone. Since the photographed

preparations were made, large quantities of material have been collected in different years.

The form selected to serve as the type of *Merrillosphaera carteri* var. *manilana* has most commonly eight gonidia, of which four form a quartet of equidistant gonidia lying in a transverse plane a little in advance of the equatorial plane and the other four form a similar quartet just back of the equatorial plane, the members of the two quartets being located on alternating longitudinal radial planes. In such cases the reproductive bodies occupy a middle zone of the coenobium and leave two polar zones without reproductive bodies. In other cases there is no empty space back of the hinder quartet. A third quartet of gonidia may be present in the hinder part of the coenobium or may be represented by fewer than all of its members. When two of these members are present they are usually on opposite sides of the polar axis. The members of the third quartet are smaller than the others, whether gonidia or daughters, and their segmentation is commonly delayed with respect to that of the others. Occasionally members of the second quartet are lacking. Some examples of the numbers and arrangements of the asexual reproductive bodies are given in the following descriptions of coenobia that have been photographed.

A mature asexual coenobium containing only asexual daughters is shown in Plate 2, fig. 8. This specimen (No. 13) is one of a collection taken from Pond C on the day after the type material was collected, and fixed on the same day. When photographed in 1916 the preparation in which it was included seemed in fairly good condition, but by 1919 most of the specimens on the slide had become disorganized. The micrograph shows a coenobium about 620 by 700 μ and an average spacing of the somatic cells of about 17 μ. These figures correspond with a cell number of about 5,200. Camera lucida sketches of six of the eight daughters gave eight gonidia in each. The other daughters were too obscure for sketching. The gonidia were about 20 to 24 μ in diameter.

A mature asexual coenobium with nine daughters is shown in Plate 6, fig. 39. This specimen (No. 14) is from the same preparation as the preceding one. From the photograph the number of somatic cells appears to be about 8,600.

A mature asexual coenobium with ten daughters is shown in Plate 5, fig. 34. This specimen (No. 15) is also from the same collection as the preceding one. It is very much flattened by the

cover glass, and the anterior pole is turned away from the observer approximately 24°. The members of the two quartets are symmetrically arranged, and the posterior pair of smaller daughters lies almost in the middle of the picture. The total number of gonidia in the ten daughters is about seventy-seven.

A mature asexual coenobium with only seven daughters is shown in Plate 6, fig. 41. This specimen (No. 16) is from the same lot as the preceding. A member of the posterior quartet is missing. A half-grown coenobium with only six gonidia is shown in Plate 2, fig. 11. This specimen (No. 17) is from the same source as the preceding. The six gonidia are about 50 to 53 μ in diameter and are very symmetrically arranged in an anterior quartet and a posterior pair.

An asexual coenobium with eleven daughters, all asexual, is shown in Plate 2, fig. 12. This specimen (No. 18) was taken on October 2 and fixed on the following day. The daughters are arranged symmetrically, eight larger ones being distributed in two quartets in the equatorial zone and the three remaining ones, which are smaller, as if in a quartet with a missing member, between the equator and the posterior polar region. In seven of the daughters it was possible to count eight gonidia. In the others not more than seven could be seen with certainty.

An asexual coenobium with eight female daughters is shown in Plate 3, fig. 18. This specimen (No. 19) is from the same collection as the one shown in Plate 1, fig. 3, but fixed a day earlier. It differs from that one mainly by having the second quartet of daughters not so far from the posterior pole of the coenobium. The oogonia in the nearest daughter numbered twenty-one and measured about 15 μ in diameter. The positions of the daughters are unfavorable for showing the part of each around the anterior pole that lacks oogonia.

The following specimens are from the same collection as the type specimen:

Specimen 20.—Plate 6, fig. 37, shows a side view of a coenobium with eight gonidia somewhat out of the typical positions. The gonidia are about 60 μ in diameter.

Specimen 21.—Plate 6, fig. 38, gives a view of a similar coenobium that is tilted about 45° away from the observer. The gonidia are 53 to 60 μ in diameter.

Specimen 22.—Plate 5, fig. 32, gives a posterior polar view of a coenobium with ten gonidia, of which the members of the hinder pair are about 53 μ and the others about 64 μ in diameter.

Specimen 23.—Plate 1, fig. 6, shows a young coenobium with eight gonidia that are mostly about 27 μ, one being about 25 μ in diameter.

Specimen 24.—Plate 3, fig. 19, shows another young coenobium with seven gonidia, of which six are about 28 μ and one about 24 μ in diameter.

From the same pond that yielded specimens 8 and 9 (Plate 4, fig. 24, and Plate 1, fig. 5) the following specimens were obtained:

Specimen 25.—Plate 2, fig. 13, shows an asexual coenobium with eight gonidia in process of division. The specimen is very much flattened by the cover glass. The reproductive body at the right in the upper row and the first and third ones in the lower row are in the 4-celled stage. The others are 2-celled. They measure about 90 μ wide.

Specimen *26*—Plate 5, fig. 33, shows an anomalous case in which one of the eight reproductive bodies is smaller than the others. It measures 28 μ wide, the others being 46 to 50 μ.

From another pond, J, on October 13, a collection was made from which the following specimens were selected:

Specimen 27.—Plate 3, fig. 17, gives a side view of a typical coenobium with nine gonidia of which the larger ones, about 46 μ wide, form two characteristic quartets and a smaller one, 35 μ wide, occupies one of the places of a third quartet.

Specimen 28.—Plate 3, fig. 15, shows an asexual coenobium with five asexual daughters and three gonidia. It is tilted approximately 12° away from the observer. The daughters are the anterior quartet and the left, distant (out of focus) member of the posterior quartet. The mother coenobium is only very slightly compressed by the cover glass, but the daughters are flattened parallel with the coenobium wall. Each of the daughters contains eight gonidia, which are about 12 μ in diameter. The gonidia of the mother are about 85 μ in diameter.

SMALLER FORM OF THE SPECIES

From a small pool, B, in Pasay, about a quarter mile from the ponds, there was taken, in company with a species of *Volvox*, what appears to be a small form of *Merrillosphaera carteri* with smaller gonidia. I shall assume that it is such and describe the specimens that are figured.

Specimen 29.—A mature asexual coenobium with eight asexual daughters is shown considerably flattened in Plate 3, fig. 20. It presents a posterior view, and near the posterior pole there is

a contracted opening through which a daughter may have been born. Each of the daughters contains eight gonidia except the upper one, which has nine. The diameter of the mother is about 570 μ (compressed to about 112 μ thick), of the uppermost daughter about 175 by 190 μ, and of the smallest about 130 by 135 μ. The number of cells in the mother was estimated to be 3,300 (probably less), in the uppermost daughter 1,700, and in the smallest daughter 1,500. The gonidia of the uppermost daughter measure 18 to 25 μ, and of the smallest 18 to 19 μ.

Specimen 30.—An asexual coenobium, Plate 5, fig. 36, with twelve reproductive bodies, ten of them segmented and two unsegmented gonidia. The two gonidia are in the hinder part of the coenobium and measure 54 and 54 by 57 μ. The others have divided into 2, 4, or 8 cells, and are in process of dividing again. The number of cells in the coenobium was estimated at 5,000, though it is probably considerably less.

Specimen 31.—An asexual coenobium with eight gonidia very symmetrically arranged is shown in Plate 2, fig. 14. It measures about 350 by 380 μ and has about 2,800 somatic cells. The gonidia measure about 50 to 55 μ.

Specimen 32.—A slightly younger asexual coenobium shown in Plate 2, fig. 9, has nine gonidia that measure about 53 μ, 55 μ, and 46 μ. The number of somatic cells was estimated to be 2,750.

Specimen 33.—A still younger coenobium with ten gonidia that do not conform to the typical arrangement is shown in Plate 3, fig. 16. In this the smaller gonidia are two, nearest the forward pole, that measure 37 and 39 μ, the others measuring 43 and 43 to 46 μ. The number of cells in the coenobium was estimated to be 1,800.

Specimen 34.—The youngest free coenobium shown of this lot is the one given in Plate 2, fig. 10. It contains twelve gonidia symmetrically arranged but with the middle quartet rather forward and separated from the hinder quartet. The number of somatic cells was estimated to be about 2,800. The gonidia measured 32 μ in the first and second groups and 28 μ in the third group.

On the same slide with the specimens numbered from 29 to 34 are twenty-two others of the same form. Some of these, like specimen 30, have the gonidia segmented. Two of these are noteworthy. They are:

Specimen 35.—This is an asexual coenobium similar to specimen 31. It has eight reproductive bodies very symmetrically

arranged. One of the hindmost four is a gonidium of about 49 μ diameter. The others have segmented into four and eight cells. This points to the undivided gonidium being probably full-grown. The number of somatic cells was estimated to be about 1,000.

Specimen 36.—The smallest coenobium with large gonidia is one measuring 213 by 220 μ and presenting an anterior view. Its somatic cells were estimated to be 730. It contains eight gonidia that are about 42 μ in diameter.

An undated slide of material from near the same source as the preceding small form bears three that are figured herewith. They are:

Specimen 37.—An asexual coenobium with eight gonidia that are all divided, two into 2 cells and the others into 8, 16, or 32 cells, is shown in Plate 5, fig. 35. In the picture the coenobium measures 400 by 425 μ. On the slide it measures only 328 by 340 μ. I would think the magnification to be wrongly stated but for the fact that the reproductive bodies are about the same size as shown in the picture.

Specimen 38.—An asexual coenobium with eight gonidia, shown in Plate 3, fig. 21, has about 1,600 somatic cells.

Specimen 39.—The smallest specimen shown is the one shown in Plate 3, fig. 22. It measured 138 by 144 μ, and was estimated to have about 500 somatic cells. It has seven gonidia of about 19 to 22 μ. The apparent angularity of the cells in the photograph is an optical effect that is more marked on those that are out of focus, and probably due in part to the shadows of the cells of the farther side of the coenobium.

A similar small form of the species was present in Pond Q in 1915. Some material taken from there on October 2 was stained with Bismarck brown, mounted in Venetian turpentine, and photographed. They all show considerable shrinkage and have shrunken further since the photographs were made.

Specimen 40.—An asexual coenobium with eight gonidia of about 35 to 40 μ diameter is shown in Plate 4, fig. 28.

Specimen 41.—An asexual coenobium with eight symmetrically arranged gonidia of about 57 μ diameter is shown in Plate 4, fig. 27. In the photograph the coenobium measures 230 μ wide and 220 μ long. In 1921 the specimen had shrunken further to 206 μ wide and 191 μ long. Most of the shrinkage occurs in the membranes. Each gonidium is contained in the outer side of a gelatinous capsule that is very thin on the outer side and so thick in other directions as to crowd the neighbor capsules so

that all form flattened surfaces of contact. There is little if any trace of a central core of the anterior part of the coenobium. If present, it is reduced to a bit about 15 μ thick and 50 μ wide. The somatic layer of cells has membranes so proportioned as to form a thin layer over each gonidium and a thick layer in other parts of the coenobium wall.

Specimen 42.—An asexual coenobium with ten daughters, shown in Plate 4, fig. 26, presents a side view with the characteristic arrangement of two groups of four and a hinder pair of smaller daughters. The central core of the anterior part of the coenobium seems to be present.

Specimen 43.—An asexual coenobium with twelve daughters is shown in Plate 4, fig. 25. In this the four hindmost daughters are smaller than the others.

CELL MEMBRANES

In some Venetian turpentine preparations of material stained with Bismarck brown the cell membranes are rendered visible, partly by the stain and sometimes, apparently, partly by the absorption of water by the membranes. One specimen from Pond E, November 1, 1914, was selected to illustrate the cell membranes. Particulars in regard to this specimen follow.

Specimen 44.—An asexual coenobium with eight daughters was photographed as shown in Plate 4, fig. 31, on May 15, 1916. On the following day it presented a different appearance and was again photographed as shown in Plate 4, fig. 30, and Plate 6, fig. 40. It was believed to have rotated with a slipping movement of the cover as a result of the slide having been left in a vertical position. The first picture seems to be a side view of a coenobium that has had the poles flattened by pressure,[4] and the others appear to be anterior polar views in which the flattened condition of the poles does not show. It is evident from all of these figures that the somatic cells form a layer, which is thin over the daughters and thick between them and over the poles. The membranes of the somatic cells form prisms with the protoplast in the outer end of each. In the thicker parts of the coenobium wall these prisms are about 18 μ high; over the daughters they grade down to only a small fraction of that height. The outer ends of the prisms are slightly convex in the photographs. By further shrinkage they have become,

[4] This flattening of the poles may have been due to great shrinkage of the parts of the coenobial core that filled the front and back of the coenobial cavity.

in 1921, very convex. So it appears that the convexity shown in the figures is probably largely a result of shrinkage. Plate 4, fig. 31, shows something of the thick capsular membranes around the daughters.

MIXED REPRODUCTIVE BODIES

Rarely (twice) coenobia were found that contained an anomalous mixture of reproductive bodies. One such from Pond F was found associated with a nearly typical form of this species. It will be described next.

Specimen 45.—Plate 3, fig. 23, shows a coenobium containing thirty-five reproductive bodies of three kinds. It measured in 1916, 435 by 440 μ with a thickness of about 300 μ. Now, in 1921, its thickness is less and its dimensions are greater. The number of somatic cells was estimated to be about 4,360. Four of the reproductive bodies are asexual daughters. In one of these eight gonidia can be counted. In the others only six or seven can be seen, though there is some obscurity. Fourteen of the reproductive bodies are cells about 42 μ wide, and seventeen are smaller cells about 26 to 32 μ wide. The former are vacuolate cells that I have supposed to be gonidia, and the latter are set down in my notes as oogonia. This assumption may be wrong. As before stated, this specimen is to be regarded as an anomaly.

MERRILLOSPHAERA CARTERI VAR. TYPICA VAR. NOV.

Carter's description ('59, pp. 2 to 5 and 18 to 19, pl. 1, figs. 1, 3, 4, 7, 8, and 10), given under the name of *Volvox globator*, will now be recast in the terminology used in the present paper. His figures of this species are reproduced herewith in Plates 7 and 8 on larger scales to make their dimensions directly comparable with the micrographs of the Philippine material. His measurements were given in fractions of an inch.

The form of the adult coenobium was described by Carter as spherical, or nearly so. The size, he stated, equals 770 μ. A nearly mature asexual coenobium which he figured (Plate 7, fig. 42) measured, according to the scale given, about 744 μ broad by 765 μ long. An oosporic coenobium which he figured (Plate 8, fig. 46) and stated to be the largest he had seen and about 608 μ in diameter, measures 606 by 616 μ. An antheridial coenobium shown in his fig. 8 (Plate 8, fig. 48) was stated to be about 270 μ and the figure measures about 283 by 287 μ. The diameter of the daughters before birth is shown to be at

least as much as 192 μ, at which time the gonidia of the daughters are about 32 to 42 μ in diameter; and, according to the figure, while the gonidia in different daughters of the same parent vary, all the gonidia in any one daughter are about equal in size. An asexual coenobium in which the gonidia had not yet segmented, as indicated by the statement that the coenobium contained only one generation, shown in his fig. 3 (Plate 7, fig. 45), measures by the figure 637 by 643 μ.

The number and size of the somatic cells were not given. These cells were described as globular and biciliated. Carter's fig. 1 *a* (Plate 7, fig. 43) of such a cell shows no intercellular protoplasmic filaments, though this point loses significance when we note that his figure of a somatic cell of a true *Volvox* on the same plate (fig. 2 *a* of his plate) shows a stellate protoplast without depicting the intercellular filaments which are characteristic of that genus.

The number of the gonidia was given as generally eight, and emphasis was laid on the statement that they are distinctly visible in the daughters before birth. The distribution of these gonidia in the coenobia was not indicated more particularly than by the specification: "Daughters confined to the posterior three fourths of the sphere, the anterior fourth being empty." The "almost mathematically regular arrangement" of the gonidia, which was emphasized by Powers ('08, p. 153) in his description of the American variety, is masked in Carter's figures by a degree of artificiality. This artificiality of the figures is evident from the fact that, of the sixty-four gonidia in his fig. 1 and the eight gonidia in his fig. 3, no two overlap. Even the overlapping of the daughters in his fig. 1 was kept down as much as possible. With this in mind, we can appreciate the probability that the arrangement of the gonidia in Carter's material was as regular as has been found in any variety of this species.

Carter's statement that each "daughter" (that is, gonidium) consists of an enlargement of a peripheral (somatic) cell referred, for illustration, to his fig. 11, which he listed as representing another species, described in the same paper, and that happens to be a true *Volvox*, wherefore we may discount its strict applicability to the species under consideration. Acording to his account (Carter '59, p. 3), as the gonidium—

> enlarges, the chlorophyll and protoplasm together are seen to form an areolar structure around the internal periphery of the cells (fig. 4), which

goes on increasing in size, and the starch-cells and chlorophyll increasing in number and quantity respectively, until a sudden re-arrangement of the gonimic contents takes place, and the whole is transformed into a globe of peripheral cells.

The figure (Plate 7, fig. 44) shows a gonidium about 85 μ in diameter. It represents the chloroplasts as forming a peripheral network with expanded nodes containing pyrenoids. The resemblance of the nodes of the chloroplast network in this figure to the somatic protoplasts of *Volvox globator* (compare Overton, '89, pl. 1, fig. 4) is so great that Klein ('89A, p. 196) was led to interpret the figure as representing a small coenobium of that species. The vacuolate protoplasm with the centrally suspended nucleus is not suggested by the drawing and was not noted in the description. It seems to me that Carter's failure to observe any details of the segmentation of the gonidia and development of the resulting embryos was probably due to lack of observations made on the living material late in the afternoon or in the night.

Antheridial or oogonial daughter coenobia were observed by Carter in mother coenobia containing also gonidial daughters. Oogonia and antheridia were not found in the same coenobium, nor were daughter coenobia of both sexes found in the same parent.

In single parents one, two, three, and even all, of the progeny were male. They were never more than half of the size of the asexual daughters. The antheridia numbered upward of one hundred in each male coenobium, and were scattered indiscriminately over the whole of the internal periphery.

The androgonidia (called spermatic cells) were described as reaching a diameter of 40 μ, his fig. 8 *a* (Plate 8, fig. 48). They underwent division to form, each, a circular, tabular group of linear ciliated sperms arranged vertically upon the same plane. The spermatozoids were supposed to number one hundred twenty-eight in each platelet. The surface-view drawing, his fig. 10 *b* (Plate 8, fig. 49 *b*), which was cited for illustration of the antheridium of this species represents about ninety-three sperms. It is to be noted that the same drawing is used for illustration of the other species that was described in the same paper.

The spermatozoids were described as linear, horn-shaped, about 11 μ long; anteriorly attenuated and colorless, posteriorly greenish; provided with a pair of cilia which are attached to the anterior extremity, and with an eyespot some distance back of the tip (Plate 8, fig. 50 *a*, *b*, *c*). The progression of the

spermatozoids was described as "vermicular from their extreme plasticity." The antheridial coenobia were liberated after the spermatozoids had been formed, but before they had become separated.

Oogonia were observed to be present instead of gonidia in two, three, or even all, of the eight daughters in asexual coenobia. In such female daughters the oogonidia numbered from thirty to fifty and were scattered indiscriminately over the posterior three-fourths of their respective coenobia. The oogonidia were two or three times the size of the somatic cells and of a light greenish color, while the daughters remained within the parent. They became still more enlarged and of a deep dark green color a short time after the daughters had been liberated.

After fertilization the oospores became surrounded by a thickened spore wall, which appeared to be "slightly wavy in its outline." The spore wall shown in his fig. 7 *a* (Plate 8, fig. 47) depicting one of these spores is characterized by Stein ('78, p. 134) and by Klein ('89A, p. 196) as being slightly toothed. The diameter of the oospores was given as about 40 μ, and the drawing of it measures about 42 μ.

MERRILLOSPHAERA CARTERI VAR. WEISMANNIA (POWERS) COMB. NOV.

Powers's description ('08, pp. 152 to 162, 172 to 175) under the name *Volvox weismannia* of material collected by Professor Wolcott at Rocheport, Missouri, will now be recast for the purpose of comparison. The data will be taken from his photomicrographic figures when they are not supplied by his text. It is to be noted that Powers wrongly called the gonidia ova.

The form of the adult coenobium is obviously, from the figures, spherical, or nearly so. The largest nearly mature asexual coenobium (his fig. 46) measure about 664 by 672 μ, and two others of about the same maturity (his figs. 37 and 55) both measure about 580 by 605 μ. The size of the coenobia at the time of segmentation of the gonidia is indicated by an 8-gonidiate coenobium (his fig. 36) in which the gonidia show a radial flattening which is the first sign of segmentation. It measures about 350 μ. A 10-gonidiate coenobium (his fig. 39), with the gonidia not yet showing signs of dividing, measures about 400 μ. No free sexual coenobia are shown. The size of the daughters before birth reaches, as appears in his fig. 55, more than 190 μ, the gonidia measuring at that time more than 22 μ in diameter. So far as can be seen in the figures,

the gonidia of the daughters before birth are about equal in size in the same daughter. This probably holds true mainly in cases in which the gonidia occur in the typical number, eight.

The number of somatic cells in the coenobia was not stated by Powers. Estimates of the number of cells in the coenobia shown in ten of his figures, based on counts of cells in small, centrally located areas,[5] with no allowance for the error due to the flattening of the coenobia for photography, give numbers ranging from 2,500 to 7,500, numbers coming between the 11th and 13th powers of 2, in which class the real numbers probably belong. Powers did not describe the somatic cells. His figures show the distance between the protoplasts to be greatest at the anterior pole and to diminish progressively toward the posterior pole, where it is least, the ratio of the intercellular distances at the opposite poles being, for example, in a nearly mature asexual coenobium (his fig. 46) nearly 2 to 1.

The number of gonidia (which Powers erroneously called ova, occasionally referring to them as primary sex cells) in the asexual coenobia he stated to be, most commonly, eight and ten, the latter number predominating. Less frequently, he stated, there are twelve. Odd numbers also occur.

The gonidia are differentiated from the somatogenic cells at about the 64-celled stage of the embryonic development; or, if not, certainly at the next step. They are large globular cells, which attain diameters of about 25 μ before birth (his fig. 37), and as great as 90 μ before segmentation (Powers, '08, p. 156), the largest that was figured (his fig. 41) being about 65 μ in diameter. They appear to be multivacuolate with a central nucleus.

The arrangement of the gonidia is almost mathematically regular. When the number is eight the arrangement is simplest and symmetrical; four lie equidistant from one another near

[5] The estimates were made by applying the formula, $N = \frac{n}{c} D^2$, in which N is the total number of peripheral cells, D the diameter of the coenobium in microns, n the number of cells counted in a selected area, and c a constant, representing $\frac{a}{\pi}$ in the formula, $N = \frac{\pi D^2 n}{a} = \frac{n}{\frac{a}{\pi}} D^2$, in which a is the area used for the counts. In this case the constant, c, was given a value of 1,000 by taking an area of 3,141 square microns. The radius of a circle having this area, multiplied by 79, the indicated linear magnification of the figures, was used for cutting a hole in a card which was placed over the figures for the counts. The diameter of that hole was about 5 millimeters.

the periphery of a transverse plane considerably anterior to the equator of the coenobium, the four others lie in the periphery of a transverse plane well toward the posterior pole and alternating with the members of the anterior quartet. When ten are present, two are usually uniformly smaller and placed between the second quartet and the posterior pole on opposite sides of the polar axis in positions more or less nearly opposite to members of the anterior quartet. When twelve are present there are two quartets of larger gonidia and a posterior quartet of smaller gonidia. Deviations in the number of gonidia occur by the omission of one or more members of one or more of the quartets or pairs. In such cases the remaining members retain their typical places.

The segmentation of the gonidia was not described, and the radial flattening of the gonidia which precedes segmentation was not recognized as such but was noted as a character of the "ova," that is, the gonidia. The account of the embryonic metamorphosis is so involved with an account of an invagination and inversion process that it is impossible to decide what of it is pathological and what of it, if any, is misinterpretation of stages of normal development. Instances of invagination in young but completely closed coenobia were sought by Powers ('08, p. 160), but not found.

The male coenobia were called dwarf male colonies. Powers records having observed one hundred thirty-one parental coenobia bearing recognizable male progeny. The number of males in a parent varied from one to ten. The progeny were exclusively male in only one instance, the one shown in his fig. 57. The unborn male coenobia are about equal in size to their unborn asexual sisters, about 210 μ in diameter. They are dwarf only in the sense of having no postnatal growth. It was stated that the sperms were ripened before the male coenobia were liberated. The number of somatic cells is small in proportion to the number of androgonidia. The sperms are formed in tabloid bundles of sixty-four and one hundred twenty-eight. The two sizes occur side by side. The sperm bundles are slightly concave, presumably on the posterior, nonciliated side. The spermatozoids are slender and have terminal cilia.

So far as it relates to female coenobia and to real oogonia Powers's account is almost blank. This fact may have a significant bearing on the consideration of Klein's account of the material collected by Migula, which is to be taken up in the next section of this paper. In Powers's inventory of the contents

of twelve coenobia he records that one daughter of No. 2 had "sixteen reproductive cells of half the size" as compared with those of its nearest sister, and No. 4 contained a "typical daughter with 18 or 20 reproductive cells." I take these to be real female daughters. Embryonic female coenobia are probably shown in his figs. 30 and 47, in which the reproductive cells, it was stated, are "probably 18 or 20" and "double the [usual] number of reproductive cells," respectively. Of the latter case Powers said: "Their position in pairs may be partially noted; also their size reduced by one-half."

No free stages of the female coenobia were described, and likewise no oospores.

MERRILLOSPHAERA MIGULAE SP. NOV.

Klein's description, under the name *Volvox aureus* ('89B), of material that had been collected and prepared by Migula in Karlsruhe, Germany, was probably less complete than it might otherwise have been, partly as a result of the treatment of the material as a mere form of a species which Klein had recently described in great detail, and partly as a result of being represented by preserved material only. The most important part of this description consists of the figures of eight coenobia with various contents. The first figure shows a coenobium which differs from typical *Merrillosphaera carteri* in being smaller, having a smaller number of somatic cells, and having the protoplasts of the latter somewhat more elongated. More-marked differences are apparent in other figures.

Before we attempt to summarize the characters of the coenobia described we have to consider the possibility or probability that certain misinterpretations were incorporated in the description. In one of the figures (Klein '98B, fig. 7) the neighboring somatic protoplasts are shown connected by proptoplasmic filaments of the kind that is characteristic of *Volvox aureus*. Since Klein definitely stated that such connecting filaments were not visible in the preparations, the drawing evidently shows more than was visible. This leads me to question whether the four reproductive cells in this coenobium, and similar cells in five other coenobia, that were called, by Klein, "recently fertilized eggs" and drawn with very distinct and apparently thickened walls, were properly interpreted and correctly drawn. In view of the unquestionable fact that such a misinterpretation was made by Powers ('08) when he called the gonidia "ova," it is not unthinkable that such an error should have been made by Klein.

Apparently an absence of female coenobia in advanced stages of development in Powers's material was a cause contributing to the error in his case, and a similar condition of the material used by Klein may have contributed to the same error in his work. Nevertheless, the simplest hypothesis for us to adopt for the purposes of the present discussion is that the large reproductive cells present in several of Klein's coenobia were in some cases gonidia, and in others the nearly ripe and the recently fertilized eggs that he called them.

The form of the coenobium in four of Klein's figures is nearly spherical, and in the other four decidedly ovoid. The dimensions [6] were given for six of the coenobia. Assuming that all of the drawings are on the same scale [7] I have measured those for which he did not give figures and here give the dimensions of all the coenobia in the order of the figure numbers: 290 by 325 μ, 345 μ, 270 μ, 225 by 260 μ, 320 by 380 μ, 290 μ, 300 μ, and 320 by 425 μ. Of the spherical coenobia, two are practically isodiametric and two are very slightly elongated. It is the polar axis, if any, that is the longer.

The somatic protoplasts were represented as round in surface view and ovoid in median optical section views of the coenobia. It was stated that the cilia were not visible under the magnification that was used for making the drawings. Measurements of the vegetative cells, by which I understand Klein to mean protoplasts, were given for all of the coenobia as follows, in the sequence of the figure numbers: 7.3 to 7.5 μ, 6.4 to 7.3 μ, 6.5 μ, 7.3 to 8.9 μ, 7 to 7.5 μ, 7.3 to 8 μ, 6.4 to 7.3 μ, and 6.4 μ.

The somatic protoplasts are farther apart at the anterior pole and the spacing is graded from one pole to the other in the drawings of all but one or two of the smaller coenobia.

The number of somatic cells present was stated by Klein for all of the mother coenobia except that of his fig. 4. I have assumed that these numbers were obtained by a method which Klein stated in his first paper ('89A, p. 146). The formula used in that procedure made no allowance for the fact that the areas occupied by the individual cells are [8] proportional to the areas of hexagons having diameters equal to the intercellular

[6] The figure 260 given for the shorter dimension of the first coenobium is obviously a misprint for 290.

[7] The scale is evidently about 152 diameters, and not 120 as stated in the explanation of the plate.

[8] As was pointed out by Janet ('12, p. 28).

distances rather than to squares having the same diameters. Hence the numbers should be larger than given, by about 15 per cent. The numbers thus revised are, respectively: 1610, 1440, 1440, —, 2180, 1675, 1675, and 2080.

The numbers of reproductive bodies present in the coenobia are 8, 11, 10, 9, 9, 10, 10, and 3, respectively. In the latter case, that of the largest coenobium, the maturity of the daughter coenobia present is such as to suggest that other daughter coenobia might have been already discharged from the mother. In all of the mother coenobia reproductive bodies are lacking in the anterior third and confined to the other two-thirds. In two coenobia the only reproductive bodies are daughters, in four they are a mixture of reproductive cells and daughters, and in the remaining two they are reproductive cells alone. These reproductive cells are mostly large, round cells with a doubly defined wall, about 55 μ in diameter, which Klein called recently fertilized eggs. In one coenobium four of these so-called fertilized eggs are accompanied by five similar cells, somewhat smaller and without the double wall, which Klein called nearly ripe eggs. Granting that these be in reality eggs and oospores, we have here a distinct species of *Merrillosphaera.* Were they resting spores developed from gonidia, we would have a distinct variety of *M. carteri;* but if they be, as I am not now inclined to believe, merely asexual gonidia that, for one reason or another, were mistaken for eggs, then the variety is hardly distinct.

The first coenobium on the plate illustrating this variety (Klein, '89B, fig. 1) is one with eight nearly equal daughters almost perfectly symmetrically arranged in two quartets.[9] One member of each quartet is a male coenobium containing androgonidia which are shown in the first and second stages of division. These male coenobia are of about the same size, 80 to 90 μ, and shape as their sisters. The latter were called female daughter colonies. It seems to me more likely that they were in reality asexual daughters. Each of them contains a small number of relatively large reproductive cells measuring 18 to 20 μ. In

[9] A coenobium almost exactly like this one is represented diagrammatically by Janet ('12, p. 117) in his fig. 14, D, under the name *Volvox aureus.* It contains three male coenobia and five asexual daughters that are mislabeled female coenobia, each of the latter containing eight or nine gonidia that are labeled gynogonidia. There is nothing in this figure essentially different from typical *Merrillosphaera carteri.* Janet's fig. 14, F, is evidently *M. migulae* with a combination of reproductive bodies not duplicating anything that was figured by Klein. In this also gonidia are labeled gynogonidia, as they are likewise in his fig. 14, E.

four daughters that are entirely visible the numbers of the reproductive cells shown are 6, 6, 7, and 8. It is not likely that the number present in any case was beyond the range of variation in the number of reproductive bodies in the mother coenobia of the preparations, for in such a case it would have attracted Klein's attention and been the subject of special remark. There is, then, no reason for regarding these daughters as other than asexual daughters, each containing well-developed gonidia, in number about the same as the eight of the mother within which the daughters were developed.

In the largest, which is evidently the most mature coenobium (Klein, '89B, pl. 3, fig. 8), from which I venture to suppose that some of the progeny had departed, there are present one male coenobium and two other coenobia which were called female. The male coenobium is fully mature, about 103 μ in diameter, and contains about two hundred thirty cells [10] including about sixty ripe spermatozoid bundles, each about 12.5 μ wide. The so-called female coenobia measured 115 and 135 μ in diameter, have vegetative cells about 4.3 μ in diameter and reproductive cells, called eggs by Klein, that are 22 to 25 μ in diameter. The numbers of the latter shown in the figure are seven and nine. These numbers are probably the total numbers found present rather than the numbers of the reproductive cells seen in the nearer hemisphere of each daughter, for the reason stated in the preceding paragraph. There is nothing about them to mark them as female.

In the four mother coenobia containing mixtures of reproductive cells and coenobia, there are altogether ten male coenobia and ten of the kind which Klein called female, but which I regard as possibly asexual. Of the six coenobia that contain progeny, five contain males and the other one contains but a single coenobium. Carter ('59) remarked, as I have already stated, that he found males and asexual coenobia in the same mother, females and asexual coenobia in the same mother, but never male and female in the same parent. A similar state of affairs in the coenobia of *M. migulae* would account for the absence of any female daughters in the coenobia figured, for there is but a single daughter in all of them that is not accompanied by male coenobia.

[10] Including the 15 per cent which I add to Klein's estimates for the reason stated on page 111.

Were I to treat this form as a variety of *M. carteri* I would be assuming that the female coenobia of the variety contain a much larger number of reproductive cells than are contained in the asexual coenobia. This would involve the assumption that no female coenobia are shown in the figures or described, and that the so-called eggs are in reality very large gonidia. Granting that the so-called fertilized eggs are actually such, then the variety has no place in *M. carteri*, but stands as a separate species of the genus.

Male coenobia of the kind found and described in Migula's preparations were observed by Klein ('90, p. 27) in the collections of the following season almost to the exclusion of another form of male coenobium which Klein had previously described for what he considered to be the same species, namely, *Volvox aureus*. After recognizing the occurrence of two forms of male coenobia, he observed that, though either form might be met with at any time during the vegetative season, as long as sexual coenobia were being formed, from May to November, nevertheless the two forms almost never occurred simultaneously in the same habitats, and when, in exceptional cases, they were so found together, it was in each case only for a short time. The male coenobia that he had described in his first paper he called, in drawing a distinction in his third paper, "normal, typical, large *Sphaerosirae*." He called them normal and typical because he took them to be like the material on which the former genus *Sphaerosira* was founded by Ehrenberg ('38).[11] The male coenobia of the kind found in Migula's preparations he called "small *Sphaerosirae*" and he further distinguished them by the name *Endosphaerosira*. The normal *Sphaerosira* averaged 350 to 450 μ in diameter and was found to reach even 750 μ. The androgonidia in this form were hardly distinguishable from the vegetative cells at the time of birth, and the development of the antheridia was correspondingly late. The *Endosphaerosira*, on the other hand, was invariably smaller, usually between 100 and 150 μ in diameter, and commonly ripened its antheridia before birth, or at least had its androgonidia segmented at that time. It also contained a much smaller number (120 to 140) of vegetative cells than the normal *Sphaerosira*, though the number of antheridia (60 to 70) was relatively larger. Klein's figure of an *Endosphaerosira* ('90, fig. 32) shows a coenobium very similar

[11] Klein ('90, p. 82) called attention to the fact that De Toni ('89, p. 536) erroneously assigned *Sphaerosira volvox* Ehrenb. to *Volvox glabator* Ehrenb., whereas it is the male coenobium of *V. aureus* Ehrenb.

to the male coenobium which Carter, in his fig. 8 *a* (Plate 8, fig. 48), had depicted in a somewhat different style and with less skill. It appears probable to me that the *Endosphaerosira* of Klein was improperly assigned to *Volvox aureus*, and that it belongs rather to one or more of the species of the genus *Merrillosphaera*.

The sperm bundles of the *Endosphaerosira*, according to Klein, contained invariably thirty-two spermatozoids.

MERRILLOSPHAERA TERTIA (MEYER) COMB. NOV.

When Meyer ('96) was working with material that he had collected at Marburg, Germany, and that he named *Volvox tertius* he, apparently, had not seen Klein's second *Volvox* paper ('89B), for he made no mention of it in either his text or his list of references. The characters appearing in Meyer's meager description, by which his material is distinguishable from Migula's material as described by Klein, are four: First, the occurrence of smaller numbers of reproductive bodies, which ranged from four to eight in a coenobium, as compared with eight to eleven; second, the occurrence of oospores in numbers greater than the numbers of asexual reproductive bodies, which were recorded as ten, twenty, and thirty, associated with four, five, and three asexually produced daughters, respectively; third, the restriction of the antheridia to the reproductive hemispheres of the male coenobia; and, fourth, the fact that in some daughter coenobia the gonidia had begun to divide while the daughters still remained within the mother coenobia. The latter point is shown by the following statement in Meyer's ('96, p. 190) text:

> * * * Die anfangs stets hellgrünen Zellen *e*? beginnen sich theilweise schon in den Tochterkugeln zu theilen, können aber auch in der Tochterkugel bis ungefähr 50 μ gross werden, ohne sich zu theilen, und sich erst theilen, wenn die Tochterkugel frei wird. * * *

The ranging of the number of asexual reproductive cells downward from eight, and the segmentation of some of the gonidia before the birth of the coenobia containing them, are characters by which Meyer's species approaches *Volvox africanus* West ('10). The occurrence of oospores in the numbers ten, twenty, and thirty is indicated only by numbers in Meyer's table of combinations of reproductive bodies found in coenobia. The data given in that table have been rearranged in Table 1 given herewith, and the three cases indicated by the letter *G* constitute the only information given about the ten, twenty, and thirty oospores.

TABLE 1.—*Combinations of reproductive bodies reported by Meyer to have been observed in his Volvox tertius, with his index leters.*

Index letter.	Daughters with segmented gonidia.	Daughters with reproductive cells.	Daughters with antheridia.	Oospores.	Total reproductive bodies.
A				6	6
C		6, 7, 8			6 to 8
D	4, 5, 6, 8				4 to 8
G	4			10	14
G	5			20	25
G	3			30	33
I	4		1		5
I	5		1		6
I	6		1		7
I	4		2		6
I	5		2		7
I	2		4		6
K	3	2			5
K	5	2			7
K	4	3			7
K	1	4			5
K	2	5			7
NB	4		1	1	6
NB		2	1	2	5

Meyer did not state the number of times that the different combinations were found, nor did he indicate whether any of the numbers or combinations of numbers were met with more frequently than others. I am inclined to regard his case *A* as another in which gonidia were mistaken for eggs or oospores on account of their great size. Likewise the one and two oospores of his *NB* cases.

Meyer's attention at the time when he described this species was directed more especially to the subject of intercellular protoplasmic connections and cell membranes. His new species differed from two species of *Volvox* in which he had made a detailed study of those connections and membranes. It entirely lacked the protoplasmic connections between the protoplasts of the adults, though such connections were said to be readily visible between the cells of living, unborn daughter coenobia (Meyer, '96, p. 200, pl. 8, fig. *a*). It differed from the other species also in the form of the membranes of the somatic cells. His diagrammatic drawings, based on careful study of stained material, are reproduced herewith as text fig. 1. The protoplasts are shown globose in form, about 7.5 μ in diameter (Meyer, '96. pl. 8, fig. *z*), and separated each from its own

outer membrane *m* by a thick gelatinous wall *w*. The space within the outer membrane of a typical cell is hemispherical in its outer half and hexagonally prismatical in its inner half, with a somewhat convex inner side. The protoplast is well within the outer half of the space. The outer membranes of the prismatical portions of neighboring cells are united to form what has the appearance of a middle lamella that is thickened at the corners *k*. A peripheral membrane *p* of the coenobium covers an intercellular space system *o*, that is filled with an intercellular substance, between the hemispherical parts of the somatic cells.

The gonidia were described as reaching diameters as great as 50 μ, and dividing either before or after the birth of the coenobia containing them. Cells similar to the gonidia were

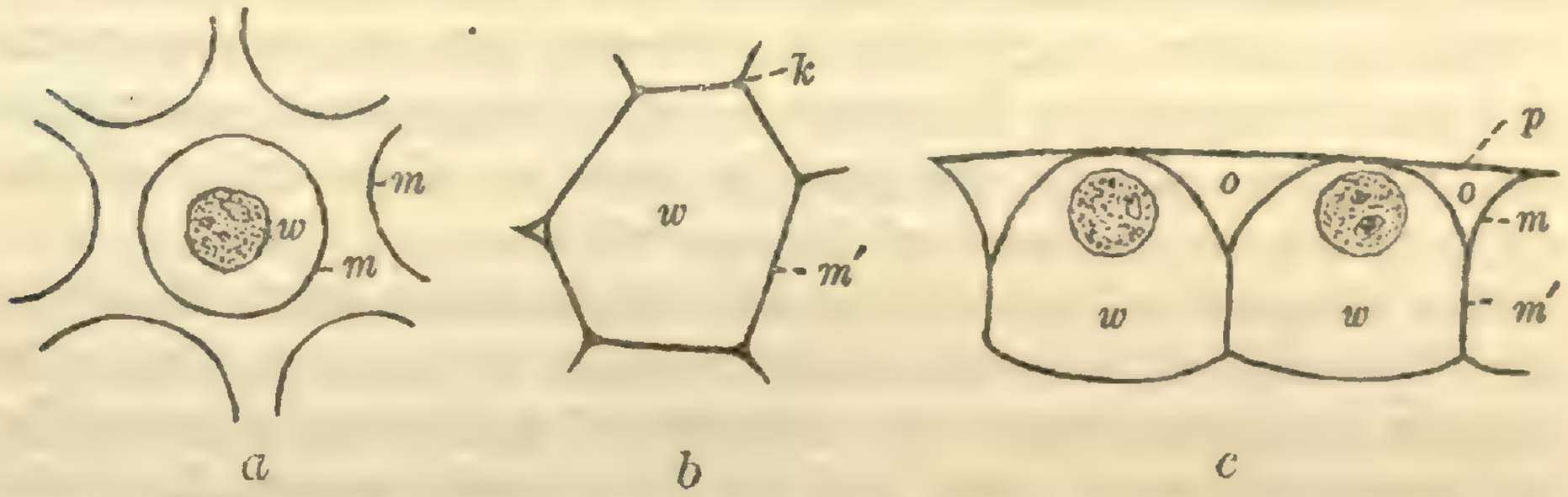

FIG. 1. Protoplasts and membranes of the body cells of *Merrillosphaera tertia* (Meyer) Shaw. *a*, tangential optical section at about the level of the middle of the outer half of the cell; *b*, similar section at about the middle of the inner half of the cell; *c*, diagrammatic radial section through body cells. The peripheral lamella, *p*, of the coenobium covers the intercellular space, *o*, filled with an intercellular mass, between the outer lamellae, *m*, of the neighboring body cells. Each protoplast is separated from the outer lamella of its wall by a thick gelatinous wall, *w*. After Meyer.

said to become dark green and become transformed into oospores when they reached diameters of 40 to 50 μ. The fertilization was supposed to take place while the coenobia containing the eggs were still within their mothers. The antheridia were produced in the reproductive halves of the male coenobia. The androgonidia segmented when 13 μ in diameter. Each produced a hemispherical or tabular bundle of spermatozoids while the male coenobium was yet within its mother. The oospores that were supposed to have been seen were described as having smooth walls.

Fuller accounts of both *Merrillosphaera migulae* and *M. tertia* will be needed before we shall be in a position to make a final decision as to whether the organisms represented by these names properly belong in the same or in different species. With our

present unsatisfactory data it is useless to attempt to predict what the ultimate systematic disposition of these forms will be. Therefore, so long as the proper status of each continues problematical, it seems more conducive to an early solution of the problems to treat them separately.

MERRILLOSPHAERA AFRICANA (WEST) COMB. NOV.

The species described by West ('10 and '18) from Africa under the name *Volvox africanus* was found in such abundance and variety about Manila that it seems desirable to reserve the description of the Philippine material for another paper. There is also in some of my material a form that is in some respects intermediate between *M. africana* and *M. carteri* that will require more study before I can decide whether to treat it as a separate species or as a variety or form of *M. africana*.

The characters that bring *M. africana* into the genus are the absence of connecting filaments between the somatic protoplasts and the large size of the gonidia that are differentiated very early in the development of the coenobium.

The characters that distinguish this species from *M. carteri* are: Coenobia smaller and ovoid; number of cells smaller; gonidia one to four, in pairs, the members of the hinder pair smaller, differentiated very early and dividing early, generally before the birth of the coenobium and often before the birth of the mother coenobium.

A diagnosis of the species based on West's description will be given after the diagnosis of the other species in a later section of this paper.

DIAGNOSES OF GENUS, SPECIES, AND VARIETIES

Genus MERRILLOSPHAERA[11] novum

(Volvocaceae, Volvoceae)

Body a spherical or ovoid coenobium of biciliate cells which contain chloroplasts. The cells appear to lie in the periphery of a gelatinous matrix surrounded by a hyaline envelope through which the cilia extend. Somatic protoplasts globose or ovoid, each inclosed in a thick gelatinous membrane which is more or less prismatic in form. No protoplasmic filaments connecting the protoplasts. Asexual reproduction by gonidia, differen-

[11] This name was first published in a footnote (Shaw, '19, p. 512) in a number of the Philippine Journal of Science that was issued March 30, 1920.

tiated in early embryonic stages,[13] which sink from positions in the layer of somatogenic cells into positions directly within the coenobium. They develop to relatively large size before segmentation. Sexual reproduction by oospores formed from oogonidia which are smaller and more numerous than the gonidia and usually borne in female coenobia, and antheridia formed from androgonidia which are smaller and more numerous than the oogonidia and borne in male coenobia. Antheridia in the form of sperm bundles or platelets that may be more or less cupped. Spermatozoids elongate, probably with terminal cilia.

The type species of this genus is *Volvox carteri* Stein, based on *Volvox globator* Carter, non Ehrenberg, described by Carter in Bombay, India. The first variety of the species to be described in sufficient detail to supply the essential diagnostic characters of the genus is *Merrillosphaera carteri* (Stein) Shaw var. *manilana* Shaw, described in this paper from material collected about Manila, Philippine Islands. Other forms are: Var. *typica* Shaw based on Carter's description of the Bombay material; var. *weismannia* (Powers) Shaw based on *Volvox weismannia* Powers described from material obtained in Missouri, North America; and species *migulae* Shaw based on the description by Klein under the name *Volvox aureus* of material obtained from Karlsruhe, Germany.

Other species are: A somewhat doubtful one, *Merrillosphaera tertia* (Meyer) Shaw (*Volvox tertius* Meyer) described from Marburg, Germany, and *M. africana* (West) Shaw (*Volvox africanus* West) described from Albert Nyanza, Africa, and reported by Shaw from the Philippine Islands.

MERRILLOSPHAERA CARTERI (Stein) comb. nov., var. **TYPICA** var. nov. Plates 7 and 8.

Volvox globator Carter, non Ehrenberg, in Ann. & Mag. Nat. Hist. III 3 (1859) 2–5, 18, 19, *pl. 1, figs. 1, 3, 4, 7, 8, and 10.*

Volvox carteri Stein in Der Organismus der Infusionsthiere. Leipzig 3[1] (1878) 134.

[13] It might more properly be said that the somatogenic cells are differentiated from the gonidia at a very early stage of the embryonic development of the coenobium, and that they become distinguishable by continuing to divide while the reproductive cells cease dividing and begin to grow. The view expressed by Harper ('18, p. 163) that *Volvox* "shows vegetative totipotence and equivalence of its cells in the growth of the colony" is obviously not applicable to any of the species of *Merrillosphaera*. Moreover, it appears likely that the gonidia in the latter genus will be found to be representative of segments in the 8- or 16-celled stage of development, and that they become differentiated when those segments have further divided two or three times.

Coenobia spherical; asexual reaching a diameter of 770 μ; female, 610 μ; and male, 270 μ. Number of somatic cells not stated; protoplasts globose, of size not stated. Gonidia generally 8, all in a coenobium of about the same size and confined to the posterior three-fourths of the coenobium; arrangement not noted. Size of gonidia at time of differentiation not noted: reaching 40 μ in daughters of about 195 μ before the birth of the daughters; attaining a diameter of 85 μ before dividing; chloroplast forming a peripheral network within the gonidium. Asexual daughters formed alone, with female daughters, or with male coenobia in the same mother coenobium. Male and female coenobia not observed in the same mother. Oogonidia 30 to 50, distributed in the posterior three-fourths of the female coenobium; reaching two or three times the size of the somatic cells in daughters yet unborn. Oospores about 40 μ in diameter, with the thickened wall "slightly wavy in its outline" or wavy toothed. Androgonidia upward of 100, scattered over the whole internal periphery of each male coenobium; reaching 40 μ in diameter; producing antheridia before the birth of the male coenobium. Antheridia consisting of platelets of 128 (?) sperms. Each spermatozoid with a pair of terminal cilia and a lateral stigma; spermatozoids liberated after the birth of the male coenobium.

Habitat.—A pool in Bombay, India (*leg.* H. J. Carter, 1858).

MERRILLOSPHAERA CARTERI (Stein) Shaw var. **MANILANA** var. nov.

Plates 1 to 6.

Coenobia spherical or slightly elongated; asexual reaching about 720 by 760 μ; female, about 690 by 730 μ; and male, about 260 by 280 μ. Number of somatic cells in asexual coenobia as high as 11,400; in female coenobia, 8,000; and in male coenobia, 2,500; commonly much fewer. Somatic protoplasts ovoid, about 5 to 6 μ thick. Gonidia 8, about equal in size, arranged symmetrically, 4 in front of, and 4 behind, the equator, sometimes with 1 to 4 additional, somewhat smaller gonidia nearer the hinder pole. Gonidia in very young coenobia about 17 μ in diameter; reaching at time of birth about 24 μ, and at maturity about 85 μ. Asexual daughters reaching about 200 μ diameter at time of birth. Male coenobia producing about 112 androgonidia. Androgonidia reaching about 16 μ; dividing before birth of the male coenobium to form sperm platelets that are more or less cupped. Female coenobia producing about 24 to 40 oogonia (oogonidia) of which none is in the front part

of the coenobium. Oogonidia about 14 μ in diameter in coenobia of about 175 μ diameter at time of birth. Oospores about 50 μ in diameter; with very slightly wavy wall about 2.5 to 3 μ thick; with eccentric protoplast about 37 μ wide.

Habitat.—Fresh-water pools, near Manila, Philippine Islands (*leg.* W. R. Shaw 1914).[14]

MERRILLOSPHAERA CARTERI (Stein) Shaw var. **WEISMANNIA** (Powers) comb. nov.

Volvox weismannia Powers in Trans. Am. Microscop. Soc. 28 (1908) 141–175, *pls. 24–26, figs. 25, 27–61.*

Coenobia spherical or nearly so; asexual reaching at maturity 664 by 672 μ; at time of segmentation of the gonidia 350 to 400 μ. Mature females not described. Male coenobia about 210 μ in diameter. Somatic cells 2,500 to 7,500; form and size not stated; intercellular distances not given, but greatest at anterior pole and grading to about half as great at the posterior pole. Gonidia 8 to 12, most commonly 10; differentiated at the 64-celled or the next stage, reaching 25 μ before the birth of the coenobium containing them and 90 μ (the largest figured was 65 μ) before segmentation. Gonidia arranged regularly in two quartets, without or with an additional pair or quartet of smaller ones from which members may be absent; occupying the posterior three-fifths of the coenobium. Female coenobia described only in very young stages within their mothers. Oogonia differentiated at an early embryonic stage; twice as numerous (16 to 20) as the gonidia. Male progeny in parental coenobia 1 to 10; before birth about equal in size to their asexual sisters. Androgonidia more numerous than oogonidia; scattered around the internal periphery of the male coenobia segmenting into antheridia and forming tabloid bundles of 64 and 128 sperms that ripen before the birth of the coenobia containing them. Spermatozoids slender, with terminal cilia. Oospores not described.

Habitat.—A broad, shallow pond near Rocheport, Missouri, North America (*leg.* Wolcott, 1904).

[14] Slide mounts of material of this species from the vicinity of Manila have been sent to Prof. Frank G. Haughwout, Bureau of Science, Manila, and to Prof. Douglas H. Campbell, Stanford University, California. Material bottled in glycerine has been sent to sixteen biologists in America and to sixteen in Europe and Asia. Duplicates of this bottled material are available for distribution from my American address: Claremont, California.—W. R. S.

MERRILLOSPHAERA MIGULAE sp. nov.

Volvox aureus Ehrenberg, Klein, in Ber. d. deutschen bot. Ges. 7 (1889) 48–53, *pl. 3, figs. 1–10;* and in Ber. d. naturf. Ges. Freiburg i. B. 5 (1890) reprint 23 and 24, 27 and 28, *pl. 2, fig. 4, pl. 4, fig. 32.*

Coenobia spherical or ovoid; asexual usually between 250 and 350 μ, reaching 320 by 425 μ; female similar; male averaging 100 to 150 μ. Number of somatic cells, 1,440 to 2,180. Protoplasts ovoid, about 7 to 8 μ in diameter. Gonidia 8, sometimes more; sometimes of uniform size and arranged in two quartets; attaining diameters of 25 μ before birth of the coenobia containing them, and probably 62 μ before segmentation. Some coenobia with gonidia and oogonidia. Female coenobia with about 8 oogonidia. Asexual, male, and possibly female coenobia formed in the same mothers, and of about the same size at time of birth. Antheridia, consisting of sperm platelets of about 12.5 μ diameter, containing 32 spermatozoids, commonly mature before birth of the male coenobia. Oospores with smooth walls, 52 to 62 μ in diameter.

Habitat.—Karlsruhe, Germany (*leg.* Migula, 1888); Buchheim, Alt-Breisach, Hochdorf, Germany (*leg.* Klein, 1888?).

MERRILLOSPHAERA TERTIA (Meyer) comb. nov.

Volvox tertius Meyer in Bot. Zeit. 54 [1] (1896) 188–191, 200–201, 216–217, *pl. 8, figs. A, Z* and *a, text figs. 5–7.*

Form and size of coenobium not stated. Number of somatic cells not given. Somatic protoplasts globose, about 7.5 μ. Membranes of somatic cells (described very particularly) hemispherical and of a thickness equal to about one-sixth of the diameter of the protoplast on the outer side, and prismatic and of a thickness equal to about one and a half times the diameter of the protoplast on the inner side. Gonidia 4 to 8 in the asexual coenobia; attaining diameters as great as 50 μ and dividing either before or after the birth of the coenobia containing them. Female coenobia doubtful. Three coenobia were reported to contain 4, 5, and 3 asexually produced daughters and 10, 20, and 30 oospores, respectively; that is, gonidia and oogonidia in the same coenobium. Oogonidia said to form oospores when they reach diameters of 40 to 50 μ. Androgonidia produced in reproductive half of male coenobium; reach 13 μ diameter; produce hemispherical or tabular bundles of sperms before the birth of the male coenobia. Oospores said to have smooth walls.

Habitat.—A pool near Marburg, Germany (*leg.* Meyer, 1895?).

MERRILLOSPHAERA AFRICANA (West) comb. nov.

Volvox africanus West in Journ. Quekett Mic. Club II 11 (1910) 102–103, *pl. 3, figs.* 8–10; and II 13 (1918) 425–428, *pl. 29, figs.* 4–6.

Coenobia ovoid; ranging from 295 by 345 μ to 480 by 610 μ. Number of somatic cells between 3,000 and 8,000. Somatic protoplasts almost globose, 8 to 9.5 μ in diameter; about 25 μ apart at anterior pole, and grading to much smaller distances at posterior pole. Gonidia 1 to 4; arranged more or less in pairs; gonidium or pair of gonidia near posterior pole smaller than the others and producing smaller daughters. Gonidia of the daughters in some cases divide and produce granddaughters containing gonidia that are the beginning of the fourth generation while the daughters are still within their mother. Daughter coenobia strongly ovoid and more or less flattened by mutual pressure; granddaughters spherical. Female coenobia with 70 to 80 oospores (average 74); oospores with thick smooth walls, average diameter 45 μ. Description of male coenobium not yet published.

Habitat.—Albert Nyanza, Africa (*leg.* R. T. Leiper, 1907); Ussangu Desert, German East Africa (*leg.* A. W. Jakubski, 1909–10); fresh-water pools near Manila, Philippine Islands (*leg.* W. R. Shaw, 1914).

LITERATURE CITED

CARTER, H. J. ('59). On fecundation in the two Volvoces, and their specific differences. Ann. & Mag. Nat. Hist. III 3 (1859) 1–20, pl. 1.

EHRENBERG, C. G. ('38). Die Infusionsthiere als vollkommene Organismen. Berlin and Leipzig (1838). (Not seen.)

HARPER, R. A. ('18). Binary fission and surface tension in the development of the colony in Volvox. Brooklyn Bot. Gar. Mem. 1 (1918) 154–166, pl. 2 and figs. 1–4.

JANET, C. ('12). Le Volvox. Limoges (1912) 151 pp.

KLEIN, L. ('89A). Morphologische und biologische Studien über die Gattung Volvox. Jahrb. f. wiss. Bot. 20 (1889) 133–211, pls. 10–12.

KLEIN, L. ('89B). Neue Beiträge zur Kenntniss der Gattung Volvox. Ber. d. deutschen bot. Ges. 7 (1889) 42–53, pl. 3.

KLEIN, L. ('90). Vergl. Untersuchungen über Morphologie und Biologie der Fortpflanzung bei der Gattung Volvox. Ber. d. naturf. Ges. Freiburg i. B. 5 (1890) 92 pp., pls. 2–6.

MEYER, A. ('96). Die Plasmaverbindung und die Membranen von Volvox, mit Rücksicht auf die thierischen Zellen. Bot. Zeit. 54 [1] (1896) 187–217, pl. 8.

POWERS, J. H. ('07). New forms of Volvox. Trans. Am. Microscop. Soc. 27 (1907) 123–149, pls. 11–14.

POWERS, J. H. ('08). Further studies in Volvox, with descriptions of three new species. Trans. Am. Microscop. Soc. 28 (1908) 141–175, pls. 23–26.

SHAW, W. R. ('94). Pleodorina, a new genus of the Volvocinae. Bot. Gaz. 19 (1894) 279–283, pl. 27.

SHAW, W. R. ('16). Besseyosphaera, a new genus of the Volvocaceae. Bot. Gaz. 61 (1916) 253–254.

SHAW, W. R. ('18). Some microtechnical methods and devices. Philip. Journ. Sci. Bot. 13 (1918) 241–261.

SHAW, W. R. ('19). Campbellosphaera, a new genus of the Volvocaceae. Philip. Journ. Sci. 15 (1919) 493–520, 2 pls.

SHAW, W. R. ('22). Janetosphaera, a new genus, and two new species of Volvox. Philip. Journ. Sci. 20 (1922) 477–508, 5 pls. 5 text figs.

STEIN, F. ('78). Der Organismus der Infusionsthiere. Leipzig 3[1] (1878) 134.

WEST, G. S. ('10). Some new African species of Volvox. Journ. Quekett Mic. Club II 11 (1910) 99–104, pl. 3.

WEST, G. S. ('18). A further contribution to our knowledge of the two African species of Volvox. Journ. Quekett Mic. Club II 13 (1918) 425–428, pls. 29 and 30.

ILLUSTRATIONS

[Photomicrographs of *Merrillosphaera carteri* (Stein) Shaw, from specimens mounted in glycerine except as otherwise noted, taken by W. R. Shaw and E. Cortes at the Bureau of Science, Manila.]

PLATE 1

FIG. 1. Type specimen of *Merrillosphaera carteri* var. *manilana*. A coenobium with eight embryo daughters. × 100.

2. A portion of the coenobium wall and one of the embryo daughters of the same specimen as that shown in fig. 1. The embryo shows in profile two protruding gonidia. × 200.

3. A mature asexual coenobium of the same variety as fig. 1, containing eight female daughters. In four of the daughters the oogonidia counted are 24, 27, 31, and 37. × 100.

4. A nearly mature female coenobium with twenty-nine oogonidia. × 100.

5. A mature asexual coenobium somewhat flattened under a cover glass. It contains four asexual daughters and three male offspring. The daughters contain eight gonidia each, and the male coenobia each about one hundred twelve androgonidia that are mostly undivided in the hindmost one and mostly 2- or 4-celled in the two others. × 100.

6. A young coenobium with eight gonidia that are 24 to 27 μ in diameter. × 100.

7. A male coenobium with the reproductive bodies developed into sperm platelets that are more or less cupped. × 100.

PLATE 2

FIG. 8. A mature asexual coenobium of *Merrillosphaera carteri* var. *manilana* with eight asexual daughters, each with eight gonidia so far as could be counted. × 100.

9. An asexual coenobium of the smaller form. It has nine gonidia that measure 53, 55, and 46 μ. × 100.

10. A young asexual coenobium of the smaller form. It contains twelve gonidia very symmetrically arranged. In the forward group two are in the middle of the picture, in the second group two are at each side, and in the hindmost group two are near the middle of the picture. The gonidia of the third group are about 28 μ wide, and the others about 32 μ. There is a noticeably large gap between the second and third groups of gonidia. × 100.

11. An asexual coenobium with only six gonidia. They are symmetrically arranged in a group of four just ahead of the middle, and a pair halfway back from them to the hinder pole. They all measure about 50 to 53 μ. × 100.

12. A mature asexual coenobium with eleven asexual daughters arranged in two symmetrical groups of four, one just ahead of, and the other just behind the middle, and three members of a hypothetical group of four smaller daughters just back of them. × 100.
13. An asexual coenobium with eight gonidia in process of division. The first three in the upper row and the second and fourth in the lower row are 2-celled. The others are 4-celled. This is from the same collection as the specimens shown in Plate 1, fig. 5, and Plate 4, fig. 24. × 100.
14. An asexual coenobium of the smaller form. It has eight symmetrically arranged gonidia of about 50 to 55 μ. × 100.

PLATE 3

FIG. 15. An asexual coenobium of *Merrillosphaera carteri* var. *manilana* with five asexual daughters and three gonidia. The daughters are the foremost four and the left (distant) member of the hindmost four. The gonidia are about 85 μ in diameter. Each daughter contains eight gonidia that are about 12 μ in diameter. × 100.

16. A young asexual coenobium of the smaller form. It has ten gonidia. They are not typically arranged. Two nearest the forward pole are the smallest, or else the figure is upside down, in which case the forward group of four is midway between the equator and the forward pole. × 100.
17. An asexual coenobium with nine gonidia in the typical arrangement of two fours with an odd one occupying one of the places of a hypothetical third group of four. The small gonidia 35 μ, the others about 46 μ wide. × 100.
18. A mature asexual coenobium with eight female daughters arranged in two symmetrical groups of four. There are twenty-one oogonidia in the nearest daughter, and they are about 15 μ in diameter. × 100.
19. A young asexual coenobium with seven gonidia of 24 to 28 μ diameter. × 100.
20. A mature asexual coenobium of the smaller form. It contains eight daughters. The uppermost of these contains nine gonidia, the others eight. The gonidia measure from 18 to 25 μ. × 100.
21. An asexual coenobium of the smaller form. It has eight gonidia and about 1,600 somatic cells. × 100.
22. An asexual coenobium of the smaller form. It has seven gonidia of about 10 to 22 μ, and about five hundred somatic cells. × 100.
23. An anomalous coenobium containing thirty-five reproductive bodies of three kinds. Four are daughters, all asexual, in one of which eight gonidia can be counted. In the others only six or seven can be seen, though there may be one or two more in obscurity. Fourteen of the bodies are about 42 μ wide and are supposed to be gonidia, and seventeen are 26 to 32 μ wide and supposed to be oogonidia. × 100.

PLATE 4

FIG. 24. A mature female coenobium of *Merrillosphaera carteri* var. *manilana* with thirty-six oospores and two immature reproductive cells. × 100.

25. A Venetian turpentine preparation of one of the smaller form. It contains twelve symmetrically arranged daughters of which the hindmost four are smaller than the others. The front of the coenobium is turned a little away from the observer. × 100.

26. A Venetian turpentine preparation of one of the smaller form from the same source as the foregoing. Ten symmetrically arranged daughters include two that are smaller than the others and form a hinder pair. The front of the coenobium is turned slightly toward the observer. × 100.

27. A Venetian turpentine preparation of one of the smaller form from the same source as the foregoing. It presents a side view showing eight gonidia symmetrically arranged. The gonidia measure about 57 μ. × 100.

28. A Venetian turpentine preparation of one of the smaller form from the same source as the foregoing. It contains eight gonidia of about 35 to 40 μ diameter. The coenobium is turned about 43° away from the observer. × 100.

29. A portion of the same coenobium as that of fig. 24 showing two of the oospores and some of the somatic cells of the coenobium wall. In a direct view some of the spore walls appear more decidedly wavy than shown in this figure. × 400.

30. A Venetian turpentine preparation stained with Bismarck brown. A nearly front polar view of a coenobium with eight daughters that form two groups of four. The thickness of the layer of somatic cells is shown to be greater between the daughters and less over the daughters. × 100.

31. The same coenobium as shown in fig. 30, photographed after being rotated 90°. The poles had been flattened. Some of the boundaries of the gonidial capsules can be seen. × 100.

PLATE 5

FIG. 32. Rear polar view of a coenobium with ten gonidia arranged in two groups of four that are about 64 μ in diameter and a hinder pair that are about 53 μ in diameter. × 100.

33. An asexual coenobium with eight gonidia in two groups of four. An anomalous member of the forward four is smaller than the others, being only 28 μ wide, while the others are 46 to 60 μ. × 100.

34. A mature asexual coenobium of *Merrillosphaera carteri* var. *manilana* with ten asexual daughters, of which there is a hinder pair of smaller ones and two very symmetrical groups of four that are about equal. The front is turned about 24° away from the observer. There are probably eight gonidia or less in each daughter. × 100.

35. An asexual coenobium of the smaller form. The eight gonidia have all divided into 2, 4, 8, 16, or 32 cells. × 100.

36. An asexual coenobium of the smaller form. It contains twelve reproductive bodies. Two of the hindmost are gonidia that measure 54 μ and 54 by 57 μ. The others have divided into 2, 4, or 8 cells each and are in process of dividing again. $\times$ 100.

PLATE 6

FIG. 37. Side view of a coenobium with eight gonidia about 60 μ in diameter. $\times$ 100.

38. An asexual coenobium with eight gonidia of about 53 to 60 μ diameter. The gonidia are fairly symmetrically arranged, but the coenobium is turned about 45° away from the observer. $\times$ 100.

39. A mature asexual coenobium of *Merrillosphaera carteri* var. *manilana* with nine asexual daughters. They form a group of four just in advance of the middle, a group of three arranged like a quartet with one member absent just back of the middle, and a pair of smaller ones a little farther back. $\times$ 100.

40. A Venetian turpentine preparation. The same as shown in figs. 30 and 31. $\times$ 200.

41. A mature asexual coenobium with seven daughters that form a symmetrical group of four slightly in advance of the middle and a group of three arranged as if members of a group of four from which one is missing. In six of the daughters eight gonidia were counted. $\times$ 100.

PLATE 7. MERRILLOSPHAERA CARTERI VAR. TYPICA

42. A reproduction of Carter's first figure ('59, *pl. 1, fig. 1*) enlarged to make the magnification about $\times$ 100. A coenobium with eight daughters, each of which contains eight gonidia. An artificiality of the drawing has resulted in failure to show the symmetrical arrangement of the daughters and gonidia in groups of four. $\times$ about 100.

43. Carter's figure ('59, *pl. 1, fig. 1 a*) of a somatic cell, showing the rounded form of the protoplast and the absence of connecting filaments. Size not stated.

44. Carter's figure ('59, *pl. 1, fig. 4*) of a gonidium about 85 μ in diameter and nearly ready to divide. $\times$ about 400.

45. Carter's figure ('59, *pl. 1, fig. 3*) of a coenobium with eight nearly mature gonidia, one of which is shown more magnified in fig. 44. The real arrangement of the gonidia is probably not shown because of an artificiality introduced into the drawing to prevent any overlapping of gonidia and at the same time leave the front of the coenobium free from reproductive cells. $\times$ about 100.

PLATE 8. MERRILLOSPHAERA CARTERI VAR. TYPICA

46. Carter's figure ('59, *pl. 1, fig. 7*) of a female coenobium. $\times$ about 100.

47. Carter's figure ('59, *pl. 1, fig. 7 a*) of an oospore after fertilization. $\times$ about 650.

48. Carter's figure ('59, *pl. 1, fig. 8 a*) of a male coenobium. $\times$ about 100.

49. Carter's figures ('59, *pl. 1, fig. 10 a* and *b*) of antheridia. × about 650.
50. Carter's figure ('59, *pl. 1, fig. 8 b*) of spermatozoids. × about 1,000.

TEXT FIGURE

FIG. 1. Protoplasts and membranes of the body cells of *Merrillosphaera tertia* (Meyer) comb. nov. After Meyer. *a*, tangential section at about the level of the middle of the outer half of the cell; *b*, similar section at about the middle of the inner half of the cell; *c*, diagrammatic radial section through body cells.

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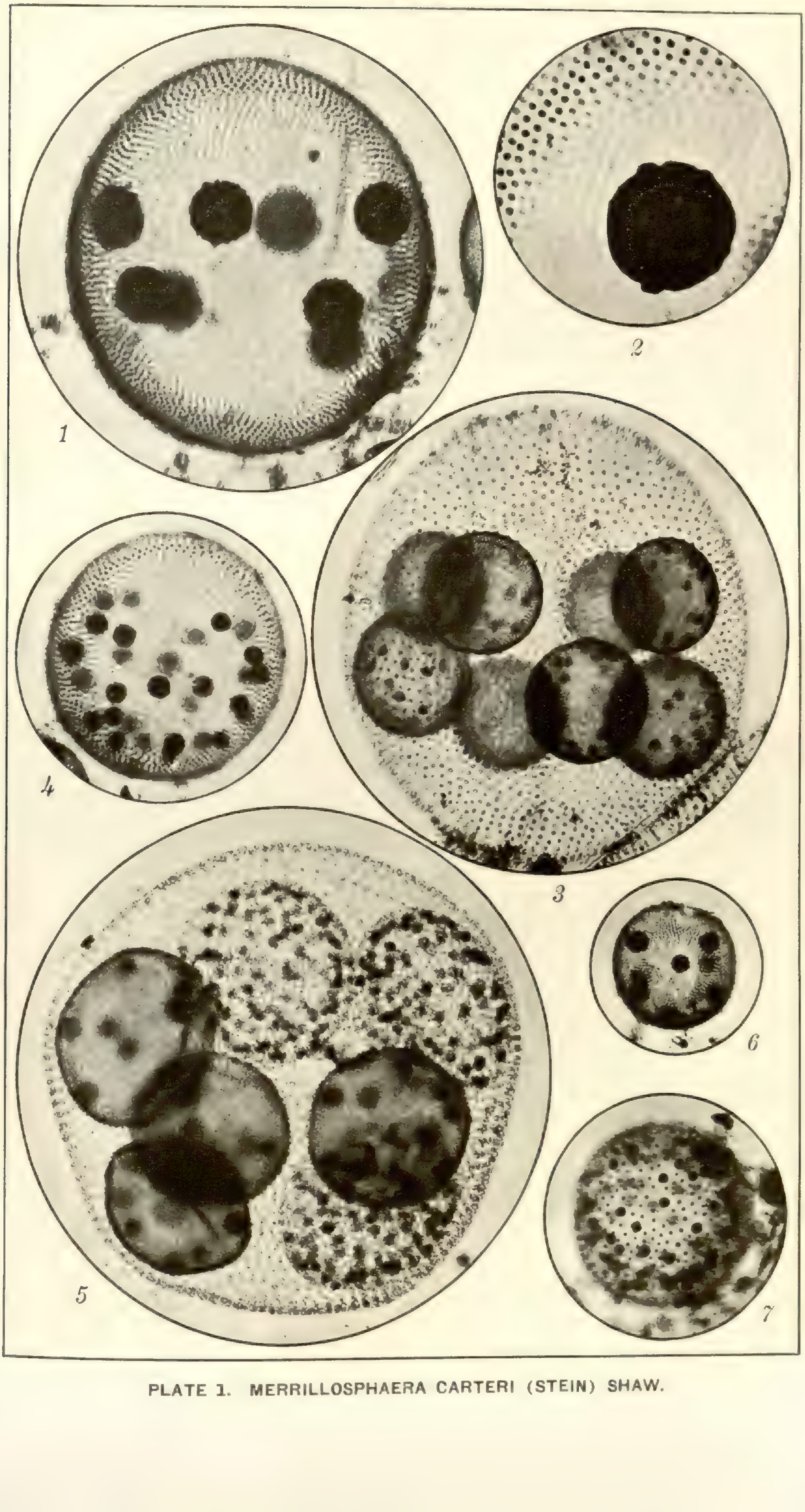


PLATE 1. MERRILLOSPHAERA CARTERI (STEIN) SHAW.

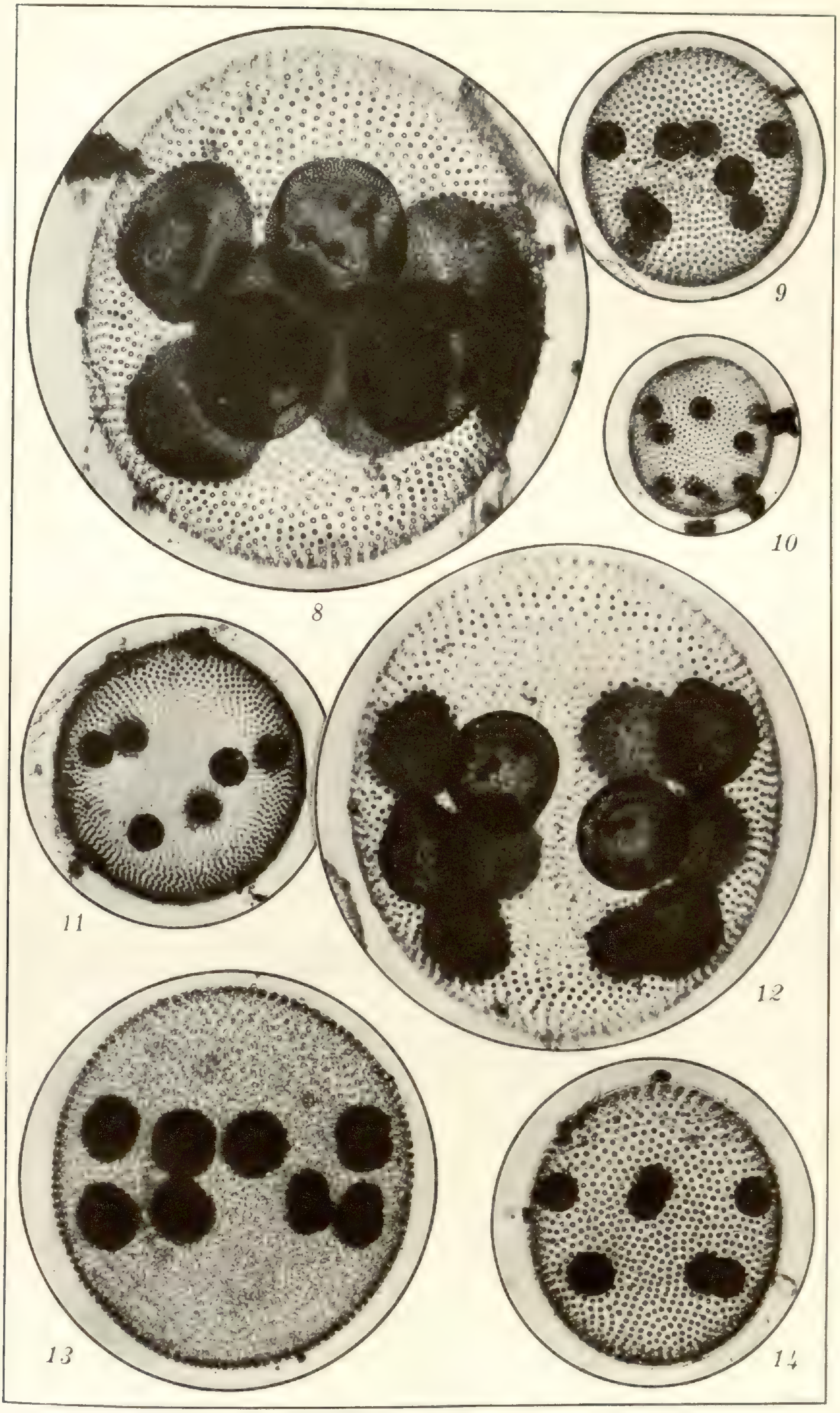


PLATE 2. MERRILLOSPHAERA CARTERI (STEIN) SHAW.

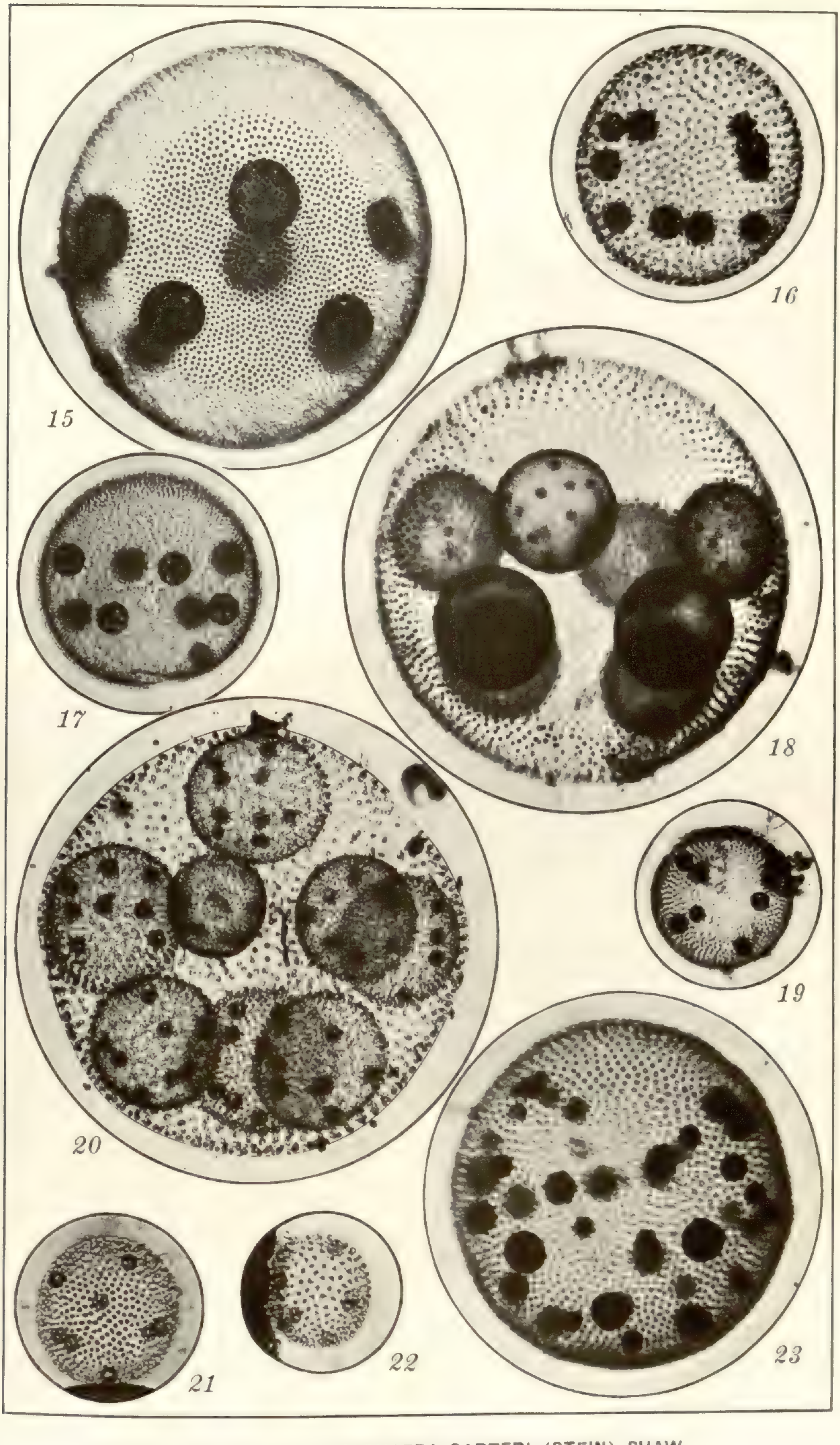


PLATE 3. MERRILLOSPHAERA CARTERI (STEIN) SHAW.

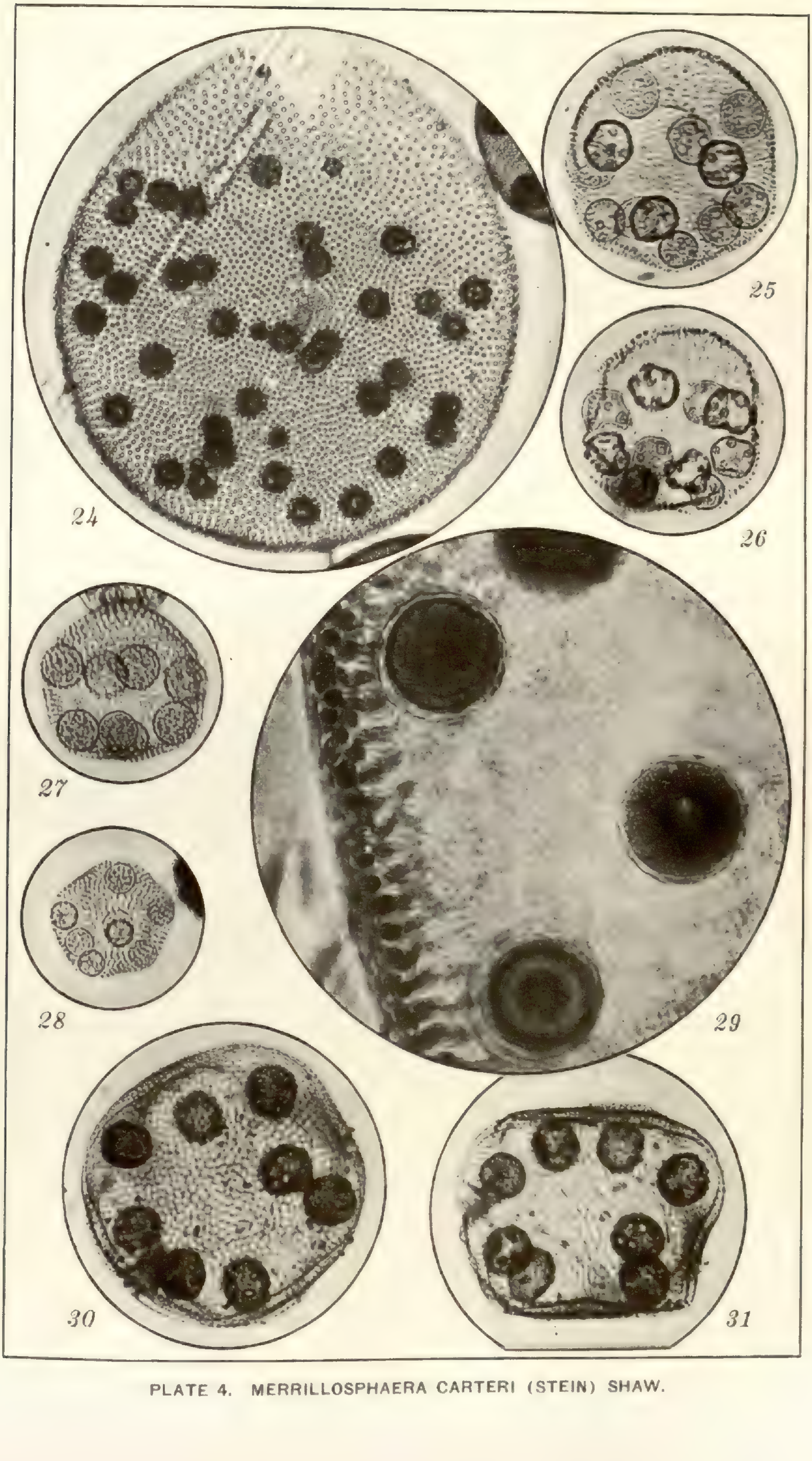


PLATE 4. MERRILLOSPHAERA CARTERI (STEIN) SHAW.

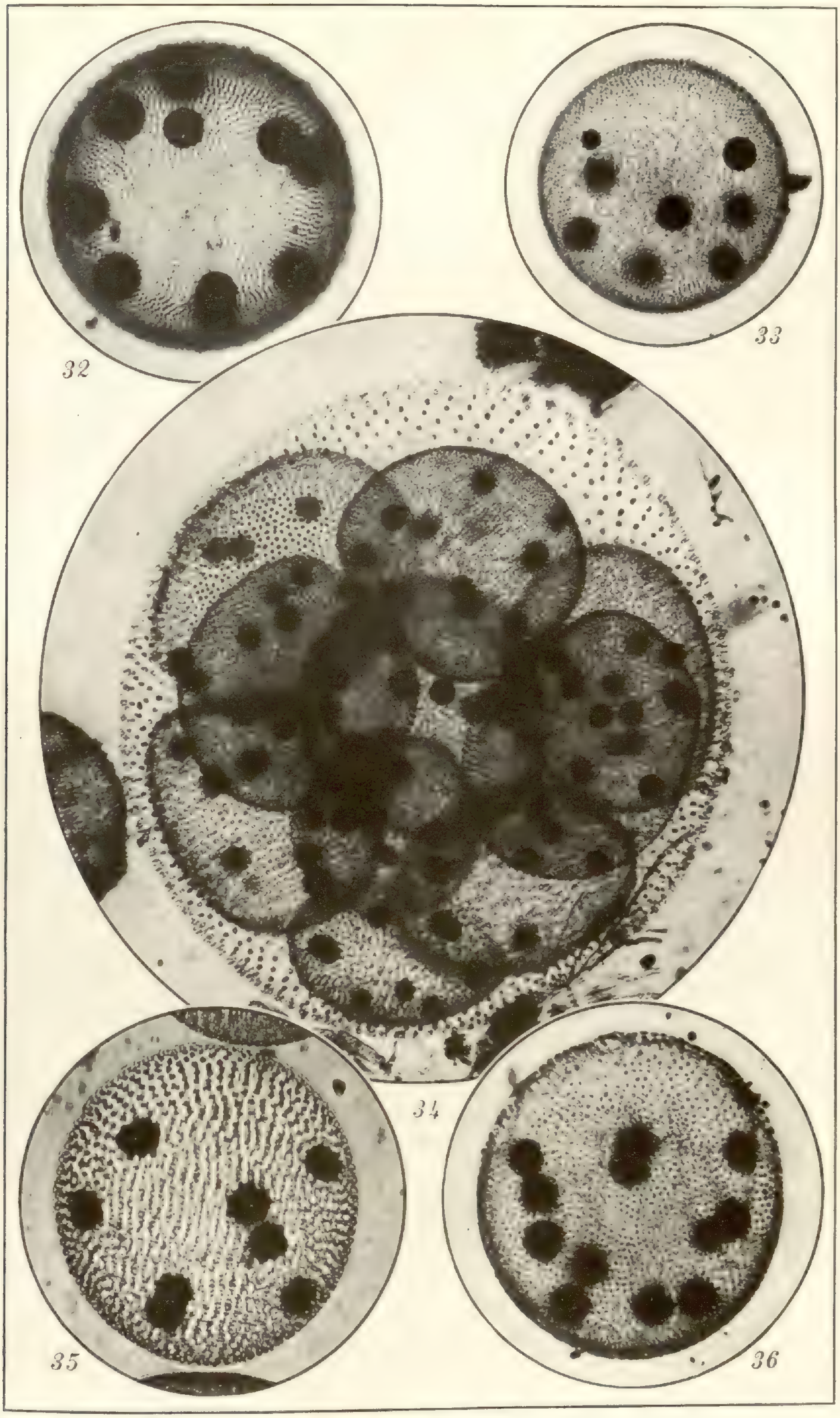


PLATE 5. MERRILLOSPHAERA CARTERI (STEIN) SHAW.

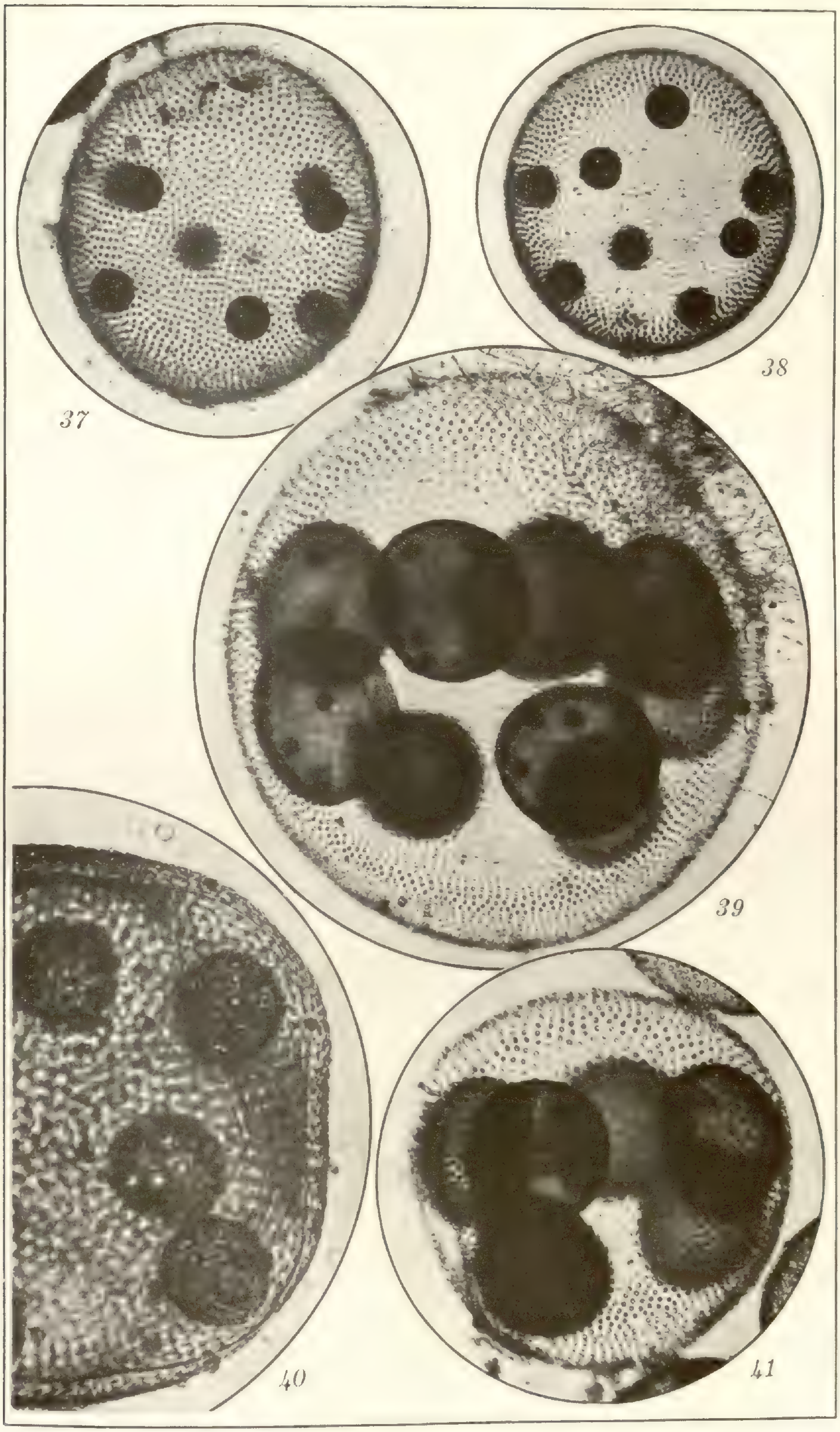
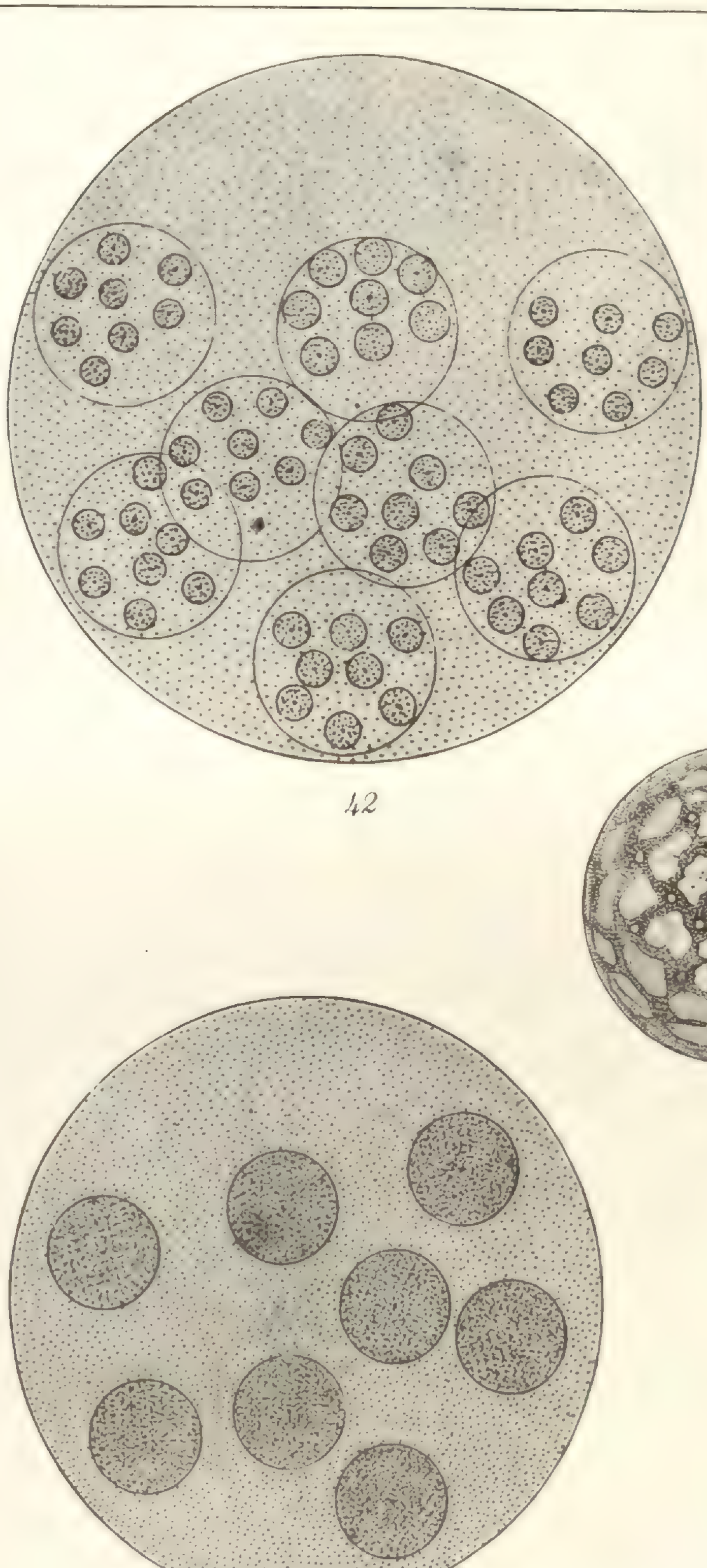


PLATE 6. MERRILLOSPHAERA CARTERI (STEIN) SHAW.



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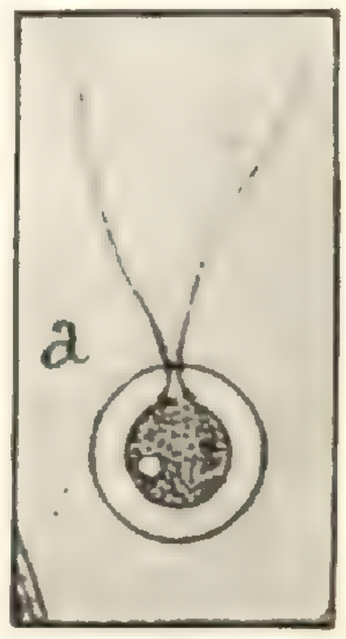

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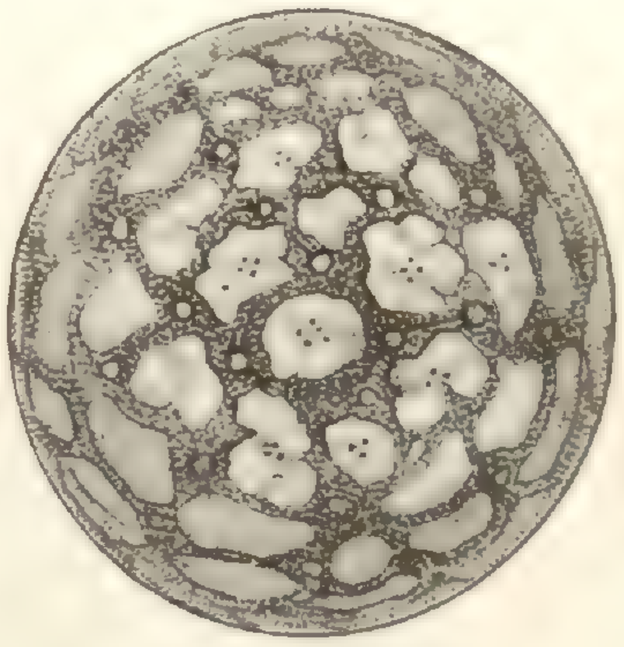

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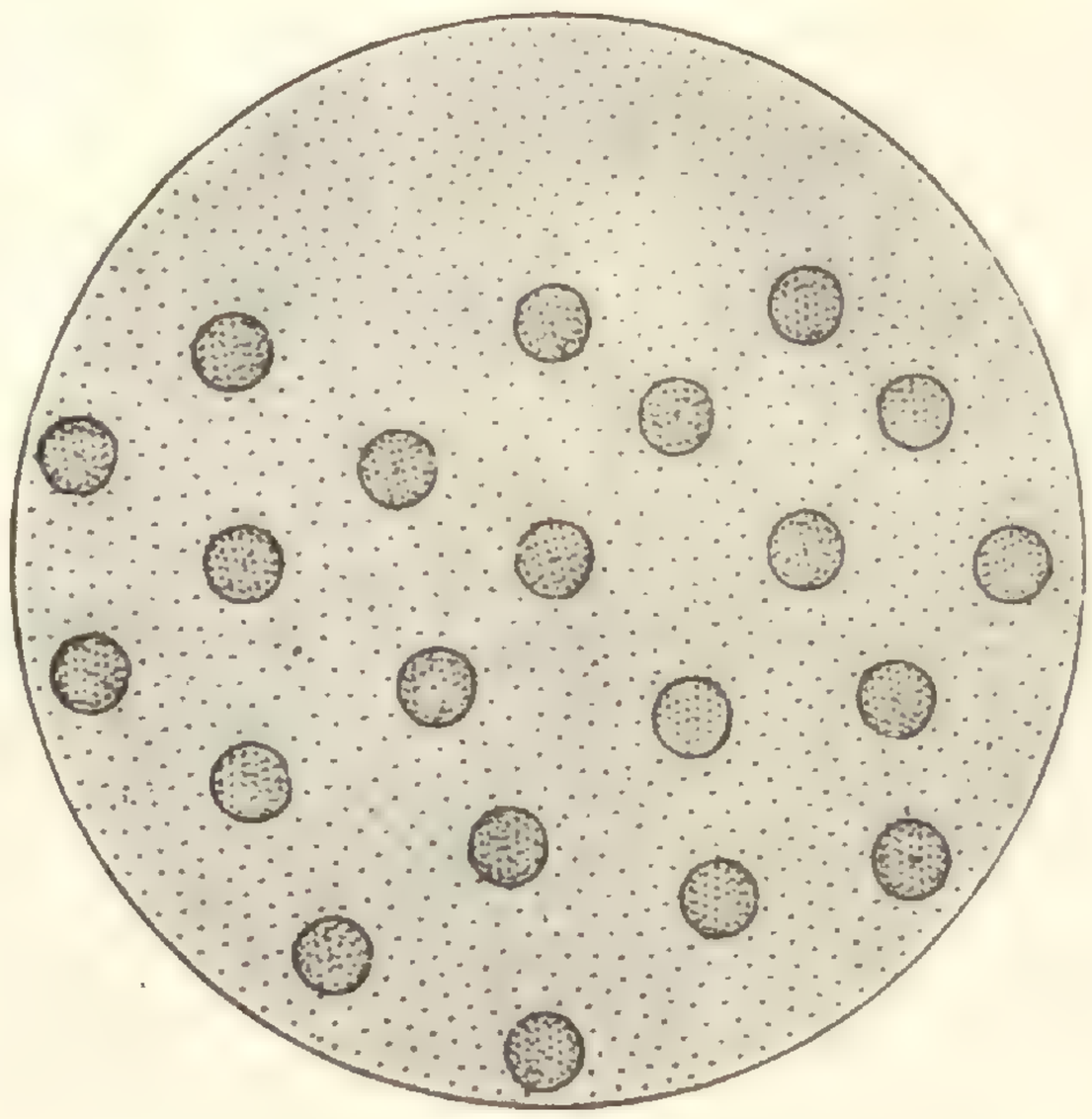
PLATE 7. MERRILLOSPHAERA CARTERI (STEIN) SHAW.



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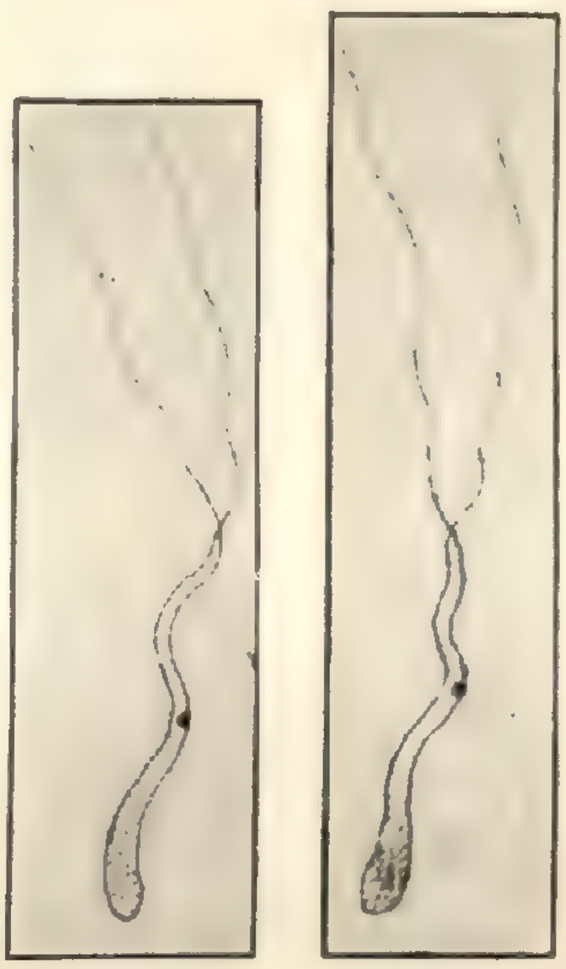
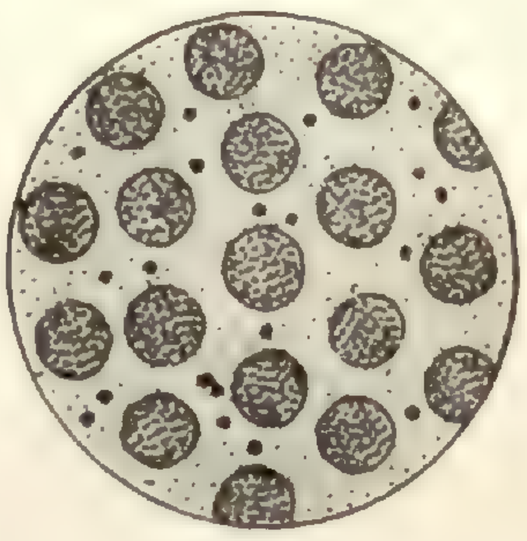


50a 50b



48

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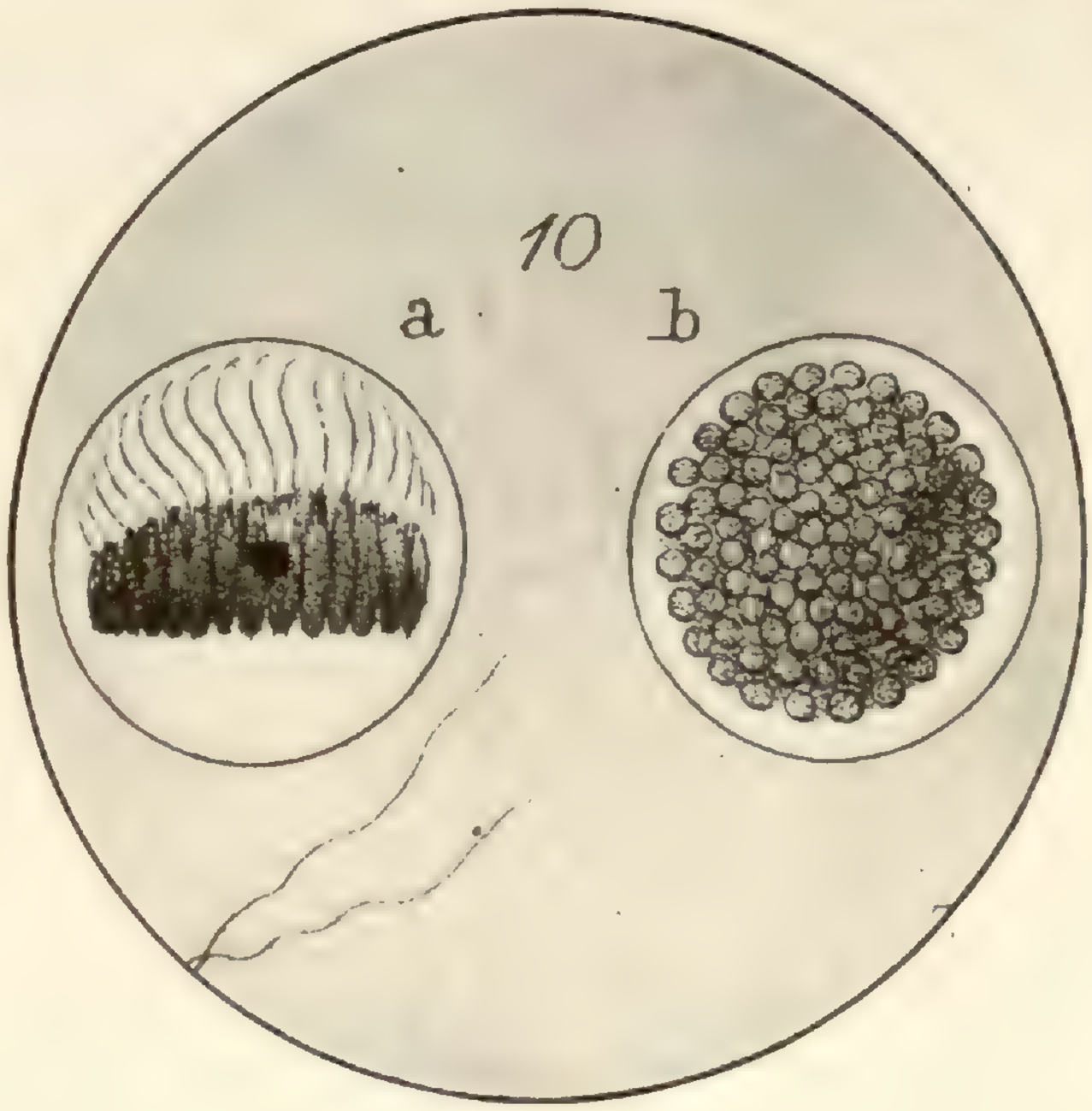

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PLATE 8. MERRILLOSPHAERA CARTERI (STEIN) SHAW.

THE PHILIPPINE
JOURNAL OF SCIENCE

VOL. 21 AUGUST, 1922 No. 2

THE AMBOINA FUNGI COLLECTED BY C. B. ROBINSON

By H. SYDOW

Of Berlin, Germany

The Robinson collection of fungi is not large but is especially interesting because it is the first collection made in Amboina. On the whole, judging from the species that are at hand, the fungus flora of this island is closely related to that of the Philippines, as various forms referable to the Basidiomycetes and to such genera as *Meliola* and *Asterina* occurring in the Philippines are especially numerous.[1]

BASIDIOMYCETES

POLYPORUS Micheli

POLYPORUS BICOLOR Jungh.

Amboina, Way tommo, *Reliquiae Robinsonianae 2244*, August 17, 1913, on a fallen log; Negri lama, *Reliquiae Robinsonianae 2304*, September 8, 1913, on rocks, being a zonate form.

POLYSTICTUS Fries

POLYSTICTUS SANGUINEUS (L.) Mey.

Amboina, Batoe merah, *Reliquiae Robinsonianae 2243*, July 20, 1913, on decaying logs.

[1] For other publications on Doctor Robinson's Amboina collections see: Merrill, E. D., An Interpretation of Rumphius's Herbarium Amboinense, Bureau of Science Publ. 9 (1917) 1–595; Reliquiae Robinsonianae, Philip. Journ. Sci. 11 (1916) Bot. 243–319; Van Alderwerelt van Rosenburgh, C.R.W.K., The Amboina Pteridophyta collected by C. B. Robinson, op. cit. 101–121, *t. 5, 6;* Brotherus, V. F., The mosses of Amboina, op. cit. 12 (1917) Bot. 73–80; Beccari, O., A new species of Calamus from Amboina, op. cit. 81; Radlkofer, L., A new species of Guioa from Amboina, op. cit. 83; Smith, J. J., The Amboina Orchidaceae collected by C. B. Robinson, op. cit. 249–262.—EDITORS.

POLYSTICTUS AFFINIS (Nees) Fr.

Amboina, Hitoe lama, *Reliquiae Robinsonianae 2090*, October 11, 1913, on dead wood.

POLYSTICTUS XANTHOPUS Fr.

Amboina, *Reliquiae Robinsonianae 2052*, on dead wood.

POLYSTICTUS DISCIPES Berk.

Amboina, Salahoetoe, *Reliquiae Robinsonianae 2108*, November 27, 1913, on old logs.

POLYSTICTUS MELEAGRIS (Berk.) Cke.

Amboina, Hitoe lama, *Reliquiae Robinsonianae 2442*, October 11, 1913, on dead wood.

POLYSTICTUS OBSTINATUS Cke. forma **RESUPINATA.**

Amboina, Batoe merah, *Reliquiae Robinsonianae 2106*, July 20, 1913, on decaying log.

FOMES (Fr.) Cooke

FOMES ADAMANTINUS Berk.

Amboina, Ayer putri, *Reliquiae Robinsonianae 2111*, July 28, 1913, on dead trees.

GANODERMA Karsten

GANODERMA AMBOINENSE (Lam.) Pat.

Amboina, *Reliquiae Robinsonianae 2052*, on dead wood.

GANODERMA TORNATUM (Pers.) Bres.

Amboina, *Reliquiae Robinsonianae 2050*, on dead trees.

TRAMETES Fries

TRAMETES CORRUGATA (Pers.) Bres.

Amboina, Way tommo, *Reliquiae Robinsonianae 2055*, August 7, 1913, on fallen log.

TRAMETES STRIGATA (Berk.) Bres.

Amboina, Paso, *Reliquiae Robinsonianae 2110*, October 29, 1913, on dead wood.

HYMENOCHAETE Léveillé

HYMENOCHAETE CACAO Berk.

Amboina, Way tommo, *Reliquiae Robinsonianae 2053*, August 7, 1913, on dead tree.

HIRNEOLA Fries

HIRNEOLA CORNEA (Ehrenbg.) Fr.

Amboina, Kati kati, *Reliquiae Robinsonianae 2192*, October 7, 1913, on corticated fence post.

UREDINACEAE

HEMILEIA Berkeley et Broome

HEMILEIA VASTATRIX Berk. et Br.

Amboina, Paso, *Reliquiae Robinsonianae 2190*, July 20, 1913, on leaves of *Coffea arabica*.

AECIDIUM Persoon

AECIDIUM KAERNBACHII P. Henn.

Amboina, town of Amboina, *Reliquiae Robinsonianae 2220*, July 17, 1913, on leaves of *Ipomoea* sp.

UREDO Persoon

UREDO KYLLINGIAE P. Henn.

Amboina, town of Amboina, *Reliquiae Robinsonianae 2217*, July 25, 1913, on leaves of *Kyllingia brevifolia*.

ASCOMYCETES

MELIOLA Fries

MELIOLA EUGENIAE Syd. sp. nov.

Amphigena, plagulas primitus orbiculares 2–3 mm diam. dein confluendo subinde irregulares aterrimas formans; mycelium densissime reticulato-ramosum, ex hyphis obscure castaneo-brunneis 8–10 μ crassis compositum; hyphopodia capitata numerosissima, recta, integra, 17–20 μ longa, cellula superiore 9–11 μ lata; hyphopodia mucronata non visa; setae mycelii numerosae, rectae vel subrectae, simplices, sursum attenuatae, sed apicibus obtusis, tota longitudine opacae, 200–300 μ longae, basi 9–11 μ latae; perithecia globosa, 200–220 μ diam.; asci bispori; sporae oblongae, utrinque late rotundatae, obscure castaneo-brunneae, opacae, 4-septatae, vix vel leviter constrictae, 44–52 μ longae, 22–25 μ latae.

Amboina, Kati kati, *Reliquiae Robinsonianae 2163*, October 6, 1913, on leaves of *Eugenia caryophyllata*.

MELIOLA AMBOINENSIS Syd. sp. nov.

Hypophylla, plagulas orbiculares 3–8 mm diam. formans; mycelium reticulato-ramosum, ex hyphis castaneo-brunneis 7–9 μ crassis rectiusculis vel curvatis compositum; hyphopodia capitata numerosa, alternantia, integra, 24–32 μ longa, cellula superiore ovata 12–14 μ lata, basali breviore stipitiformi; hyphopodia mucronata non visa; setae myceliales copiosae, simplices, rectiusculae vel leviter falcato-curvatae, tota longitudine opacae, ad apicem semper acutae, 300–650 μ longae, basi 9–10 μ

crassae; perithecia globosa, in sicco collapsa, 150–200 μ diam.; asci 2- ad 3-spori, fugaces; sporae cylindraceae, utrinque obtusae, castaneae, 4-septatae, non vel vix constrictae, 33–36 μ longae, 13–15 μ latae.

Amboina, Gelala, *Reliquiae Robinsonianae 2150*, September 19, 1913, on leaves of *Aganosma* sp.

MELIOLA FAGRAEAE Syd.

Amboina, Hitoe messen, *Reliquiae Robinsonianae 2134bis*, November 5, 1913, on leaves of *Fagraea speciosa*.

MELIOLA PACHYCHAETA Syd. sp. nov.

Epiphylla, raro hypophylla vel petiolicola, plagulas orbiculares 4–8 mm diam. velutinas aterrimans formans, mycelium ex hyphis dense reticulato-ramosis et intertextis 7–10 μ latis brunneis septatis (articulis 10–20 μ longis) compositum; hyphopodia capitata copiosa, alternantia vel opposita, cylindracea, recta vel subrecta, 20–24 μ longa, cellula superiore majore integra vel raro leviter irregulari 10–12 μ lata, hyphopodia mucronata non visa; setae mycelicae copiosae, rectae vel subrectae, simplices, tota longitudine omnino opacae, ad apicem acutae, 600–1000 μ longae, basi 15–18 μ latae; perithecia gregaria, globosa, 175–250 μ diam.; asci 2- vel 3-spori, fugaces, sporae cylindraceae, utrinque obtusae, 4-septatae, leviter constrictae, brunneae, 36–42 μ longae, 12–15 μ latae.

Amboina, Batoe merah, *Reliquiae Robinsonianae 2059*, August 24, 1913 (type); Koesoekoesoe sereh, *Reliquiae Robinsonianae 2246*, August 7, 1913, both on leaves of *Semecarpus cassuvium*.

Meliola pachychaeta seems to be related to *M. aliena* Syd. from which it differs especially in the much larger setae.

MELIOLA STEMONAE Syd. sp. nov.

Epiphylla, plagulas minutas orbiculares 1–3 mm diam. formans; mycelium matrici dense adpressum, radians, ex hyphis brunneis 7–11 μ crassis ramosis septatis compositum, hyphopodia capitata modice copiosa, alternantia 18–22 μ longa, cellula superiore 15–18 μ lata, integra, recta vel curvata, cellula basali minore; hyphopodia mucronata non visa; setae mycelii copiosissimae, rectae vel leviter curvatae, 600–800 μ longae, basi 10–12 μ latae, tota longitudine opacae vel subinde ad apicem dilutiores, ad apicem dentibus 1–3 irregularibus acutis vel obtusis plus minus longis subinde brevissimis usque 20 μ longis erectis praeditae, subinde sed raro etiam subter apicem dente singulo praeditae; perithecia gregaria, in sicco collapsa, atra, 150–250 μ diam.; asci 2- ad 3-spori; sporae oblongae, utrinque rotundatae,

4-setatae, ad septa leviter constrictae, fuscae, 44–51 μ longae, 17–20 μ latae.

Amboina, Hitoe lama, *Reliquiae Robinsonianae 2230*, October 8, 1913, on leaves of *Stemona tuberosa*.

MELIOLA ROBINSONII Syd. sp. nov.

Amphigena, plerumque epiphylla, plagulas minutas 1–3 mm diam. tenues subinde confluendo majores formans; mycelium dense reticulato-ramosum ex hyphis brunneis 7–10 μ crassis septatis formatum; hyphopodia capitata copiosa, alternantia vel opposita, 20–24 μ longa, recta vel cellula superiore integra curvata 10–14 μ lata, cellula basali brevi; hyphopodia mucronata opposita, lageniformia, usque 23 μ longa; setae myceliales numerosae, rectae, opacae vel dimidia parte superiore pellucidae, 200–300 μ longae, basi 7–9 μ latae, ad apicem dentibus 1–4 erectis mox brevissimis mox longioribus (usque 15 μ longis) acutis praeditae; perithecia globosa, 150–175 μ diam., in sicco collapsa; asci 2- ad 3-spori; sporae oblongae, utrinque rotundatae, 4-septatae, ad septa vix vel leviter constrictae, brunneae, 40–44 μ longae, 18–20 latae.

Amboina, Soja, *Reliquiae Robinsonianae 2119*, August 2, 1913, on leaves of *Entada phaseoloides*.

MELIOLA MEGALOCHAETA Syd. sp. nov.

Amphigena, praecipue hypophylla, plagulas 0.5–2 cm latas primitus orbiculares dein irregulares et saepe confluendo majores formans; mycelium reticulato-ramosum, ex hyphis atro-brunneis opacis 9–12 μ crassis rectiusculis compositum; hyphopodia capitata sat numerosa, integra, 26–35 μ longa, cellula superiore rotundata, plerumque recta, 16–20 μ lata, inferiore brevi; hyphopodia mucronata solitaria vel opposita, numerosa, lageniformia, in collum plus minus abrupte producta, usque 32 μ longa, basi ca. 10 μ crassa; setae myceliales numerosae, rectae, rigidae, praelongae, 1,000–1,500 μ longae, basi 12–17 μ latae, atrae, opacissimae, ad apicem tantum dilutiores et saepe pellucidae, sive simplices obtuse attenuatae vel rotundatae, sive dentibus 2–4 irregularibus erectis acutis brevissimis vel elongatis usque 15 μ longis praeditae; perithecia pauca in quaque plagula, globosa, 200–250 μ diam.; asci 2- ad 3-spori; sporae oblongo-ellipsoideae, utrinque rotundatae, centro crassiores, atro-brunneae, subopacae, 4-septatae, ad septa non vel vix constrictae, 48–51 μ longae, 22–24 μ latae.

Amboina, Hitoe messen, *Reliquiae Robinsonianae 2078*, October 13, 1913, on leaves of *Kibara moluccana*.

MELIOLA ODONTOCHAETA Syd. sp. nov.

Amphigena vel caulicola, plagulas aterrimas primitus orbiculares 2–4 mm diam. dein irregulares confluentesque formans; mycelium reticulato-ramosum, ex hyphis rectiusculis vel leviter undulatis brunneis 7–8 μ crassis compositum; hyphopodia capitata copiosissima, alternantia, 22–28 μ longa, integra vel subintegra, cellula superiore oblonga recta vel curvata 10–13 μ lata, inferiore breviori stipitiformi; hyphopodia mucronata opposita, rara, 20–26 μ longa, basi 8–10 μ lata; setae myceliales copiosae, rectae vel leviter curvatae, 600–800 μ longae, basi 10–12 μ latae, tota longitudine opacae, ad apicem dentibus 2–6 mox brevissimis et 1–2 μ tantum longis, mox elongatis usque 12 μ longis erectis praeditae, paucae subinde ad apicem obtusae haud denticulatae tuncque dilutiores immixtae; perithecia globosa, in sicco collapsa, 200–220 μ diam.; asci 2- ad 3-spori; sporae oblongae, utrinque rotundatae, brunneae, 4-septatae, 44–50 μ longae, 16–20 μ latae, cellulis mediis latioribus.

Amboina, Hitoe lama, *Reliquiae Robinsonianae 2187*, October 8, 1913, on leaves of *Dischidia* sp.

MELIOLA CANARII Syd.

Amboina, town of Amboina, *Reliquiae Robinsonianae 2072*, July 18, 1913, on leaves of *Canarium commune*.

MELIOLA CLAVULATA Wint.

Amboina, town of Amboina, *Reliquiae Robinsonianae 2129*, July 31, 1913, on leaves of *Ipomoea pes-caprae*.

MELIOLA DESMODII Karst. et Roum.

Amboina, Hitoe lama, *Reliquiae Robinsonianae 2256*, November 1, 1913, on leaves of *Desmodium gangeticum;* Ayer putri, *Reliquiae Robinsonianae 2180*, July 28, 1913, on leaves of *Desmodium umbellatum*.

MELIOLA MANGIFERAE Earle.

Amboina, Hitoe messen, *Reliquiae Robinsonianae 2118*, November 5, 1913, on leaves of *Mangifera indica*.

MELIOLA PELLICULOSA Syd.

Amboina, Paso, *Reliquiae Robinsonianae 2185*, October 31, 1913, on leaves of *Lumnitzera racemosa*.

MELIOLA SAKAWENSIS P. Henn.

Amboina, Soja, *Reliquiae Robinsonianae 2124*, August 4, 1913, on leaves of *Clerodendron speciocissimum*.

APPENDICULELLA Von Hoehnel

APPENDICULELLA CALOSTROMA (Desm.) v. Hoehn.

Amboina, town of Amboina, *Reliquiae Robinsonianae 2115*, July 23, 1913, on leaves of *Rubus fraxinifolius*.

PARODIELLA Spegazzini

PARODIELLA PARAGUAYENSIS Speg.

Amboina, Batoe mera, *Reliquiae Robinsonianae 2184*, July 20, 1913, on leaves of *Desmodium triflorum*.

DIATHRYPTON Sydow genus novum

Mycelium superficiale, copiose evolutum, ramosum, septatum, hyphopodiatum. Perithecia ad hyphas mycelii orta, ovato-globosa, astoma, cellulosa, mollia, mox et facile histolyse mucosa dissoluta, monoascigera. Asci aparaphysati, octospori. Sporae bicellulares, coloratae.

DIATHRYPTON AMBOINENSE Syd. sp. nov.

Amphigenum, praecipue epiphyllum, plagulas tenerrimas atro-griseas variae dimensionis formans; mycelium copiose evolutum, ex hyphis rectis vel rectiusculis copiose et saepe opposite ramosis fuscis 4–5 μ crassis septatis (articulis variae longitudinis 8–25 μ longis) compositum; hyphopodia numerosa, unilateralia vel saepius et praecipue ad hyphas primarias crassiores opposita, continua, lageniformia, 12–15 μ longa, basi 5–7 μ crassa; perithecia dense gregaria, ad hyphas mycelii orta, ovato-globosa, astoma, 45–60 μ alta, mollia, tenuiter cellulosa, pariete mox et facile histolysis ope in cellulas dilute brunneas rotundatas vel angulosas 6–10 μ diam. dissoluto, monoascigera; asci ovato-globosi, octospori, aparaphysati, 40–50 μ longi, 35–42 μ lati; sporae ellipsoideo-oblongae, utrinque rotundatae, medio septatae et valde constrictae, 21–26 μ longae, 10–13 μ latae, loculis aequalibus vel supero subinde paullo latiore, facillime secedentibus.

Amboina, Hatalai, *Reliquiae Robinsonianae 2092*, October 24, 1913, on leaves of *Schuurmansia elegans*.

The new genus is closely related to *Phaeoschiffnerula* Theiss. from which it differs by the monoascigerous perithecia. These originate from the hyphopodia as is the case with *Ph. compositarum* Theiss.[2] We have seen a few isolated brown conidia, first two-celled, and later four-celled, measuring about 20–26 by 8–9 μ. Perhaps these have originated from the mycelium;

[2] Verhandl. Zool. bot. Ges. Wien (1916) 337.

this, however, could not be made out with absolute certainty. The brown hyphae of the mycelium are all connected by a very thin, nearly hyaline pellicle in which here and there slender, subhyaline or yellowish hyphae, 1–2 μ broad, are to be seen. We have found a similar pellicle in *Phaeoschiffnerula.*

AUERSWALDIA Saccardo

AUERSWALDIA EXAMINANS (Mont. et Berk.) Sacc.

Amboina, Kati kati, *Reliquiae Robinsonianae 2228*, October 28, 1913, on bark of decaying tree.

PHYLLACHORA Nitschke

PHYLLACHORA PHASEOLINA Syd.

Amboina, Kati kati, *Reliquiae Robinsonianae 2154*, October 6, 1913, on leaves of *Vigna* sp.

CATACAUMA Theissen et Sydow

CATACAUMA MICROPLACUM Syd. sp. nov.

Stromata hypophylla, irregulariter sparsa vel aggregata, irregulariter rotundata, minutissisma, punctiformia, 0.33–0.5 mm diam., subinde bina confluentia et tunc paullo majora, peripherice plana, opaca, centro convexa, unilocularia, clypeo epidermali, opaco; asci clavati, paraphysati, 45–60 μ longi, 11–18 μ lati, octospori; sporae 1- ad 2-stichae, ellipsoideae, continuae, hyalinae, 11–13 μ longae, 5–6 μ latae.

Amboina, Koeda mati, *Reliquiae Robinsonianae 2257*, on leaves of *Ficus* sp.

Related to *Catacauma apoense* Syd., but differing in the smaller stromata and spores.

CATACAUMA ROBINSONII Syd. sp nov.

Stromata epiphylla, sparsa, plerumque orbicularia, 4–8 mm diam., opace atra, vesiculose convexa, ostiolis nitidis, multilocularia, haud raro stromate hypophyllo opposito sterili praesente; clypeo epidermali, opaco, 30–40 μ crasso; asci paraphysati, clavati, 50–80 μ longi, 11–18 μ lati, octospori; sporae monostichae vel distichae, ellipsoideae vel oblongae, continuae, hyalinae, 13–18 μ longae, 7–8 μ latae.

Amboina, Binting, *Reliquiae Robinsonianae 2242*, August 13, 1913, on leaves of *Ficus* sp.

This form, which is closely related to *Catacauma infectorium* (Cke.) Theiss. et Syd., is characterized by the regular stromata and the comparatively large spores.

TRABUTIA Saccardo et Roumeguère

TRABUTIA AMBOINENSIS Syd. sp. nov.

Stromata epiphylla, valde variabilia et irregularia, minora 2 mm tantum diam., majora usque 1 cm longa vel lata, plerumque in greges usque 2 cm longos irregulariter disposita et confluentia, opace atra, vesiculose convexa, ostiolis nitidis, clypeo opaco ca. 30–40 μ crasso; loculi copiosi, 350–420 μ lati, 150–250 μ alti, pariete brunneolo ca. 20 μ crasso; asci clavati, 60–80 μ longi, 11–20 μ lati, paraphysati, octospori; sporae mono- vel distichae, ellipsoideo-oblongae, continuae, hyalinae, 17–18 μ longae, 8–9 μ latae.

Amboina, Koesoekoesoe sereh, *Reliquiae Robinsonianae 2096*, October 3, 1913, on leaves of *Ficus hasskarlii*.

This species must be compared with *Trabutia Butleri* Theiss. et Syd. and *T. Elmeri* Theiss. et Syd. from which it differs but slightly in the form and arrangement of the very irregular stromata.

HYSTEROSTOMELLA Spegazzini

HYSTEROSTOMELLA TETRACERAE (Rud.) v. Hoehn.

Amboina, Amahoesoe, *Reliquiae Robinsonianae 2212*, September 16, 1913, on leaves of *Delima* (*Tetracera*) *Boerlagei*.

ARMATELLA Theissen et Sydow

ARMATELLA LITSEAE (P. Henn.) Theiss. et Syd.

Amboina, Hitoe messen, *Reliquiae Robinsonianae 2112*, November 1, 1913, on leaves of *Litsea* sp.; Soja and Hatalai, *Reliquiae Robinsonianae 2091, 2179*, October 24, 1913, on leaves of *Neolitsea amboinensis* Merr.

AULACOSTROMA Sydow

AULACOSTROMA PANDANI (Rostr.) Syd.

Amboina, town of Amboina, *Reliquiae Robinsonianae 2098, 2258*, July 19, 1913, on leaves of *Pandanus;* Gelala, *Reliquiae Robinsonianae 2107*, September 19, 1913, on leaves of *Pandanus humilis*.

ACTINODOTHIS Sydow

ACTINODOTHIS PIPERIS Syd.

Amboina, Gelala, *Reliquiae Robinsonianae 2208*, July 16, 1913, on leaves of *Piper* sp.; Ayer putri, *Reliquiae Robinsonianae 2235*, July 29, 1913, on leaves of *Piper sarmentosum*.

ASTERINA Léveillé

ASTERINA SPECTABILIS Syd. sp. nov.

Amphigena, praecipue epiphylla, plagulas primitus orbiculares 2–4 mm latas dein subinde confluendo majores formans; mycelium copiose evolutum, ex hyphis obscure castaneis rectis opposite ramosis 8–11 μ crassis septatis (articulis 12–30 μ longis) compositum, hyphopodia copiosa, fere semper opposita, saepe longa serie regulariter disposita continua, crasse cylindracea, obtusa, integra, 10–20 μ longa, 9–12 μ lata; thyriothecia gregaria, rotundata, 200–300 μ diam., ex hyphis rectis 3 μ crassis septatis (articulis 10–16 μ longis) obscure brunneis contexta; asci ovato-globosi, aparaphysati, 50–80 μ longi, 40–50 μ lati, octospori, pauci in quoque thyriothecio; sporae oblongo-ellipsoideae, utrinque rotundatae, 1-septatae, ad septum constrictae, brunneae, leves, 35–42 μ longae, 18–20 μ latae, loculis aequalibus vel supero paullo latiore; pycnidia simul praesentia minora, rotundata, 90–140 μ diam., conidia ellipsoidea vel ovata, continua, obscure castaneo-brunnea, subopaca, 24–28 μ longa, 18–20 μ lata.

Amboina, Ayer putri, *Reliquiae Robinsonianae 2126*, July 28, 1913, on leaves of *Flacourtia inermis*.

ASTERINA VENUSTULA Syd. sp. nov.

Epiphylla, plagulas orbiculares tenues 3–5 mm diam. formans; mycelium tenue, matrici dense adpressum, ex hyphis fuligineis laxe ramosis leviter undulatis vel subrectis 3–4 μ crassis remote septatis (articulis 15–30 μ longis) compositum; hyphopodia sat numerosa, unilateralia vel opposita, cylindracea, 10–15 μ longa, 4–4.5 μ lata, integra vel subintegra, continua, recta vel leviter curvata; thyriothecia dense gregaria, orbicularia, 150–175 μ diam., ambitu copiose undulato-fimbriata, ex hyphis radiantibus fuscis ca. 3 μ crassis strato singulo contexta, stellatim dehiscentia; asci ovato-globosi, aparaphysati, octospori, 32–40 μ longi, 25–30 μ lati; sporae oblongae, leves, brunneae, 20–23 μ longae, 8–9 μ latae, 1-septatae, loculis fere aequalibus.

Amboina, town of Amboina, *Reliquiae Robinsonianae 2088, 2252*, July 18, 1913, on leaves of *Averrhoa bilimbi* L.

ASTERINA ASSIMILIS Syd. sp. nov.

Epiphylla, plagulas orbiculares 2–5 mm latas tenues formans; mycelium ex hyphis rectangulariter ramosis septatis (articulis 15–20 μ longis) 5–7 μ crassis obscure castaneo-brunneis compositum; hyphopodia modice copiosa, dispersa, alternantia vel unilateralia, continua, crasse cylindracea, 10–17 μ longa, 7–9 μ

lata; thyriothecia gregaria, orbicularia, 200–300 μ diam., radiatim ex hyphis rectis ca. 3 μ crassis septatis (articulis 5–10 μ longis) brunneis contexta; asci ovati vel oblongi, 60–80 μ longi, 30–40 μ lati, octospori, aparaphysati; sporae ovato-ellipsoideae vel ovato-oblongae, infra medium septatae, hinc loculis conspicue inaequalibus, vix vel leviter constrictae, fuligineae, leves, 24–26 μ longae, 13–15 μ latae.

Amboina, Kati kati, *Reliquiae Robinsonianae 2157*, October 6, 1913, on leaves of *Eugenia caryophyllata* Thunb.

This species is closely related to *Asterina ditissima* Syd. from which it differs in the longer, cylindric, and less-numerous hyphopodia, and in the conspicuously unequal-septate spores.

ASTERINA DIAPHORELLA Syd.

Amboina, Wae, *Reliquiae Robinsonianae 2147*, November 26, 1913, on leaves of *Sideroxylon* sp. aff. *attenuatum*.

ASTERINA PUSILLA Syd.

Amboina, Paso, *Reliquiae Robinsonianae 2181*, October 31, 1913, on leaves of *Premna obtusifolia*.

ASTERINA SPONIAE Racib.

Amboina, near the town of Amboina, *Reliquiae Robinsonianae 2161*, July 27, 1913, on leaves of *Trema* sp.; Hitoe messen, *Reliquiae Robinsonianae 2151*, November 5, 1913, on leaves of *Trema amboinensis*.

PRILLIEUXINA Arnaud

PRILLIEUXINA LORANTHI Syd. nom. nov.

Asterinella loranthi Syd. in Philip. Journ. Sci. 8 (1913) Bot. 490. (Type from Leyte, *Bur. Sci. No. 15243a*, on leaves of *Loranthus leytensis*.)

Amboina, Koesoekoesoe sereh, *Reliquiae Robinsonianae 2247*, August 23, 1913, on leaves of *Loranthus rumphii*.

PRILLIEUXINA MICROSPILA Syd. sp. nov.

Epiphylla, plagulas minutas tenues orbiculares 1–3 mm diam. formans; mycelium ex hyphis irregularibus fuscidulis ramosis anastomosantibus septatis 3–4 μ crassis haud hyphopodiatis compositum; thyriothecia dense gregaria, copiosa, orbicularia, 150–200 μ diam., e strato singulo hypharum subrectarum fusciduarum 2–3 μ crassarum septatarum (articulis 4–6 μ longis) contexta; asci ovato-globosi, aparaphysati, octospori, 35–50 μ longi, 25–40 μ lati; sporae oblongae, utrinque late rotundatae, fuscidulae, leves, medio septatae et valde constrictae, 21–24 μ longae, 9–10 μ latae, loculis aequalibus vel supero leviter latiore.

Amboina, town of Amboina, *Reliquiae Robinsonianae 2214*, August 20, 1913, on leaves of *Leucosyke capitellata*.

PRILLIEUXINA AMBOINENSIS Syd. sp. nov.

Hypophylla, rarius etiam epiphylla, plagulas orbiculares vel irregulares 2–5 mm diam. formans; mycelium copiose evolutum, radians, ex hyphis septatis ramosis vel anastomosantibus obscure fuscis 4–6 μ crassis torulosis haud hyphopodiatis sed hinc inde ramulos breves hyphopodia simulantes emittentibus compositum; thyriothecia sat numerosa, gregaria, rotundata, 200–400 μ diam., ambitu fimbriata, opaca, subatra, ex hyphis ca 3 μ latis radiatim contexta, stellatim dehiscentia; asci ovati vel subglobosi, aparaphysati, octospori, 45–60 μ longi, 25–45 μ lati; sporae oblongae, utrinque rotundatae, fuscae, medio septatae et valde constrictae, leves, 26–35 μ longae, 13–15 μ latae, loculis fere aequalibus vel supero leviter latiore.

Amboina, Hoetoemoeri Road, *Reliquiae Robinsonianae 2174*, September 30, 1913, on leaves of *Cordyline terminalis*.

The new species is most nearly related to the Philippine *Asterinella calami* Syd. from which it differs in the characters of the mycelium and in its smaller spores.

PARASTERINA Theissen et Sydow

PARASTERINA MELANOTES Syd. sp. nov.

Epiphylla, plagulas orbiculares conspicuas 4–8 mm diam. formans; mycelium ex hyphis rectiusculis intertextis ramosis septatis 8–10 μ crassis atro-brunneis compositum; hyphopodia sparsa, solitaria, hemisphaerica, ca. 10 μ alta et lata; thyriothecia dense gregaria, irregulariter rotundata, 400–700 μ diam., aterrima, omnino opaca, centro valde elevata, radiatim contexta, peripherice hyphis obscure castaneo-brunneis 6–8 μ latis plus minus longe fimbriata; asci copiose evoluti, paraphysati, ovato-globosi, octospori, 60–85 μ longi, 50–60 μ lati; sporae oblongae, utrinque late rotundatae, leves, fuscidulae, 35–40 μ longae, 17–19 μ latae, loculis aequalibus vel supero paullo latiore.

Amboina, Hitoe messen, *Reliquiae Robinsonianae 2203*, October 13, 1913, on leaves of *Polyosma brachyantha*.

CALOTHYRIUM Theissen

CALOTHYRIUM VILE Syd. sp. nov.

Thyriothecia nudo oculo aegre perspicua, epiphylla, in greges effusos laxe disposita, rotundata, 150–300 μ diam., radiatim ex hyphis flavo-fuscidulis 2–3 μ latis contexta, mycelio libero perparco, ex hyphis undulatis vel torulosis 3–4 μ crassis haud hyphopodiatis composito, hymenio plano simplici pluriascigero; asci

clavati vel clavato-saccati, octospori, aparaphysati, 50–80 μ longi, 18–22 μ lati; sporae oblique monostichae vel distichae, obpiriformes vel elongato-obovatae, hyalinae, 1-septatae, non vel leviter constrictae, 18–24 μ longae, 9–12 μ latae, loculo supero majore.

Amboina, Hitoe messen, *Reliquiae Robinsonianae 2102*, October 14, 1913, on leaves of *Phoebe macrophylla*.

LEMBOSIA Léveillé

LEMBOSIA ROBINSONII Syd. sp. nov.

Epiphylla, plagulas irregulares usque 1 cm diam. vel confluendo majores formans; mycelium ex hyphis rectiusculis 7–10 μ crassis obscure castaneo-brunneis irregulariter reticulato-ramosis septatis compositum; hyphopodia sparsa, alternantia, cylindrico-elevata, continua, integra, 12–17 μ longa, 8–10 μ lata; thyriothecia laxe gregaria, primitus rotundata et 300–500 μ diam., mox autem exacte linearia et usque 1.25 mm longa et 200–300 μ lata, centro elevata, opaca, carbonacea, ambitu fimbriata, radiatim ex hyphis 3–4 μ crassis contexta; asci ovato-globosi, 70–90 μ longi, 35–55 μ lati, octospori; paraphyses distinctae, copiosae, ca. 2 μ crassae; sporae oblongo-ellipsoideae, utrinque rotundatae, leves, fuligineae, leviter constrictae, 34–38 μ longae, 17–19 μ latae, loculis aequalibus vel fere aequalibus.

Amboina, Hitoe messen, *Reliquiae Robinsonianae 2188* (type), *2158*, both collected November 6, 1913, on leaves of *Eugenia* sp.

The species differs from *Lembosia eugeniae* Rehm in the characters of the mycelium, hyphopodia, and smaller spores. It is more nearly related to *Parasterina pemphidioides* (Cke.) Theiss., but differs notably in the exactly lembosoid form of the thyriothecia and the one-celled hyphopodia.

ECHIDNODES Theissen et Sydow

ECHIDNODES XENOSPILA Syd. sp. nov.

Epiphylla, partibus matricis atro-decoloratis et peculiariter quasi dendritice effiguratis usque 1 cm latis insidens; mycelium liberum parum evolutum, ex hyphis brunneolis ramosis anastomosantibus ca. 3 μ crassis fuscis haud hyphopodiatis compositum; thyriothecia laxe disposita, plerumque recta, linearia, 350–450 μ longa, 120–180 μ lata, rima longitudinali dehiscentia, contextu atro opaco radiato; asci ovati vel ovato-globosi, 35–45 μ longi, 30–35 μ lati, octospori; paraphyses haud numerosae, ad apicem leviter incrassatae, sporae conglobatae, oblongae, leves, ex hyalino fuscae, 1-septatae, vix vel parum constrictae, utrinque rotundatae, 22–25 μ longae, 9–10 μ latae, cellula superiore plerumque leviter crassiore sed breviore.

Amboina, Hitoe messen, *Reliquiae Robinsonianae 2134,* November 5, 1913, on leaves of *Fagraea speciosa,* growing together with *Meliola fagraeae* Syd.

THYROSOMA Sydow genus novum

Mycelium nullum. Thyriothecia superficialia, brunnea, ex hyphis radiantibus contexta, membrana basali distincta nulla, hymenia multa polyascigera includentia, polyostiolata. Asci in plectenchymate hyalino fibroso dein evanescente siti, sessiles, octospori, aparaphysati. Sporae hyalodidymae.

THYROSOMA PULCHELLUM Syd. sp. nov.

Thyriothecia amphigena, praecipue hypophylla, sparsa, solitaria, ambitu orbicularia, 1–1.5 mm diam., centro 80–100 μ crassa, plana, superficialia, centro opaca et pluristratosa, ad peripheriam tantum pellucida, ex hyphis amoene radiantibus rectis vel rectiusculis ca. 2 μ crassis peripherice brunneolis centrum versus obscurioribus septatis (articulis 8–14 μ longis, ad peripheriam longioribus) composita; asci sessiles, ventricosi, saccati vel elongati, 40–55 μ longi, 15–18 μ lati; sporae oblongae, hyalinae, circa medium 1-septatae, non constrictae, 16–18 μ longae, 5–6 μ latae, cellula superiore late rotundata paullo breviore et latiore, cellula inferiore paullo longiore sed angustiore.

Amboina, Way tommo, *Reliquiae Robinsonianae 2146, 2057,* November 26 and August 17, 1913, on leaves of *Erythroxylum ecarinatum.*

EREMOTHECA Theissen et Sydow

EREMOTHECA PHILIPPINENSIS Syd.

Amboina, Hitoe, *Reliquiae Robinsonianae 2175,* October 8, 1913, on leaves of *Aporosa sphaeridophora.*

BYSSOGENE Sydow genus novum

Ascomata in hypothallo ex hyphis asperatis brunneis ramosis composito superficialiter insidentia, atra, in maturitate patelliformia, extus ad basim hyphulis obsessa. Loculi unistratosi, in parenchymate minute celluloso siti. Asci solitarii, ovati vel oblongi, aparaphysati, octospori. Sporae muriformes, hyalinae.

BYSSOGENE AMBOINENSIS Syd. sp. nov.

Hypophylla, plagulas primitus orbiculares 3–10 mm diam. tandem saepe confluentes tuncque irregulares et majores fumoso-brunneas formans; mycelium copiosissime evolutum, densum, ex hyphis brunneis vel opace brunneis ramosis remote septatis 4–5 μ crassis densissime asperatis compositum; ascomata in

mycelio superficialia, sparsa, primitus globoso-clausa, in maturitate patelliformia, margine elevato, atra, usque 1 mm lata, extus rugosa et praecipue ad basim hyphulis obsessa, parenchymatica, in superiore parte minute flavo-brunnee vel brunnee parenchymatica, in inferiore parte grossius et obscurius atre vel subatre parenchymatica, cellulis 5–7 μ diam.; loculi unistratosi, in superiore stromatum parte siti; asci ovati, oblongi vel subclavati, antice crasse tunicati, aparaphysati, 40–52 μ longi, 18–25 μ lati, octospori; sporae elongato-obovatae, superne late rotundatae, basim versus leviter attenuatae, sed obtusae, transverse 3-septatae non vel vix constrictae, loculis 2–3 vel omnibus septo longitudinali iterum divisis, hyalinae, 15–17 μ longae, 8–10 μ latae.

Amboina, Batoe mera, *Reliquiae Robinsonianae 2105*, September 24, 1913; Ayer putri, *Reliquiae Robinsonianae 2170*, July 29, 1913; both on leaves of *Eugenia* sp.

The new genus belongs to the Saccardiaceae; it is somewhat related to *Calopeziza* Syd., but differs especially in the black ascomata and colorless spores.

CALLORIOPSIS Sydow

CALLORIOPSIS GELATINOSA (Ell. et Mart.) Syd.

Amboina, town of Amboina, *Reliquiae Robinsonianae 2156*, July 28, 1913, parasitic on *Meliola* on leaves of *Cerbera manghas* (*C. odollam*).

PILOCRATERA P. Hennings

PILOCRATERA HINDSII (Berk.) P. Henn.

Amboina, Lateri, *Reliquiae Robinsonianae 2222*, September 5, 1913, on dead wood.

FUNGI IMPERFECTI

DIPLODIA Fries

DIPLODIA FRUCTUS-PANDANI P. Henn.

Amboina, locality not given, *Reliquiae Robinsonianae 2109*, on fruits of *Pandanus dubius*.

ASTEROSTOMELLA Spegazzini

ASTEROSTOMELLA POLYSTIGMA Syd. sp. nov.

Epiphylla, plagulas primitus minutas et discretas mox autem confluentes et totam folii superficiem plus minus occupantes formans; mycelium ex hyphis rectiusculis sed dense ramosis 3–4 μ crassis septatis fuscidulis compositum; hyphopodia modice copiosa, continua, sessilia, valde et varie lobata, plerumque latiora quam altiora, 9–11 μ lata, 7–8 μ alta; thyriothecia copio-

sissima, dense gregaria, punctiformia, 60–85 μ diam., plerumque rotundata, radiatim ex hyphis 2.5–3 μ crassis rectiusculis crebre septatis fuscidulis contexta, stellatim dehiscentia; conidia continua, fusca, ovata vel piriformia, 14–17 μ longa, 10–13 μ lata.

Amboina, town of Amboina, *Reliquiae Robinsonianae 2167*, August 23, 1913, on leaves of *Hemigraphis* (vel *Peristrophe?*) sp.

GLOEOSPORIUM Desmazières et Montagne

GLOEOSPORIUM ALCHORNEAE Syd.

Amboina, Hitoe lama, *Reliquiae Robisonianae 2143*, October 8, 1913; Amahoesoe, *Reliquiae Robisonianae 2237*, September 18, 1913; both on leaves of *Alchornea rugosa*.

PESTALOZZIA De Notaris

PESTALOZZIA PALMARUM Cke.

Amboina, Batoe mera, *Reliquiae Robinsonianae 2065*, July 20, 1913, on drying leaves of *Cocos nucifera*.

CLADOSPORIUM Link

CLADOSPORIUM ZIZYPHI Karst. et Roum.

Amboina, Binting, *Reliquiae Robinsonianae 2145*, November 18, 1913, on leaves of *Zizyphus jujuba*.

HELMINTHOSPORIUM Link

HELMINTHOSPORIUM FICINUM Sacc.

Amboina, Soja, *Reliquiae Robinsonianae 2204, 2234*, August 31 and August 2, 1913; Lateri, *Reliquiae Robinsonianae 2114*, September 5, 1913; Wae, *Reliquiae Robinsonianae 2136*, November 27, 1913; all on leaves of *Ficus wassa*.

APPENDIX

The following four numbers were collected by the late Doctor Robinson on the same trip, before reaching Amboina.

MELIOLA SAKAWENSIS P. Henn.

Boeton, Baoebaoe, *Reliquiae Robinsonianae 2509*, July 13, 1913, on leaves of *Clerodendron* (*minahassae?*). Celebes, Macassar, *Reliquiae Robinsonianae 2466*, July 11, 1913, on leaves of *Clerodendron* sp.

PHYLLACHORA CATERVARIA (Berk.) Sacc.

Boeton, Baoebaoe, *Reliquiae Robinsonianae 2507*, July 13, 1913, on leaves of *Ficus* sp.

PARASTERINA PEMPHIDIOIDES (Cke.) Theiss.

Celebes, Macassar, *Reliquiae Robinsonianae 2468*, July 11, 1913, on leaves of *Eugenia jambolana*.

PHILIPPINE MANTIDS, OR PRAYING INSECTS

By F. WERNER

Of Vienna University, Vienna, Austria

ONE PLATE

Through the kindness of my friend Dr. H. H. Karny, I was enabled to examine a small but highly interesting collection of mantids, consisting of sixty specimens, collected by Prof. Charles Fuller Baker, of the College of Agriculture, Los Baños, Philippine Islands. For this courtesy I am much indebted to Professor Baker, and hope he will further devote a part of his time to the collection of mantids, as our knowledge of the Philippine species seems still very far from perfect, as can easily be seen when not less than six species out of twenty prove to be new to science.

Under the circumstances it is much too early to comment upon the geographical distribution of Philippine mantids; still many years of study will be required before we can say that we know the mantid fauna of Luzon alone. However, I hope that resident naturalists, seeing the remarkable effect of present collecting, will not cease to give attention to this interesting group of insects.

In the systematic arrangement of species I have followed Giglio-Tos, whose monographic works on mantids, based on very rich material, must be regarded as the foundation for future systematic work on the insects of this family. It is significant of the paucity of Philippine material in European collections that, among the immense numbers of new species described by Giglio-Tos, hardly a half dozen are from the Philippine Islands.

EREMIAPHILINÆ

Metallyticus violaceus Burmeister.

Middle and hind femora dark at apex; abdomen entirely blue below; no red spots on head. The species has already been recorded from the same locality by Hebard.[1]

MINDANAO, Zamboanga, 1 female.

[1] Proc. Acad. Nat. Sci. Philadelphia 72 (1920) 18.

IRIDOPTERYGINÆ

Tropidomantis tenera Stål.

Eng. Resa Ins. (1858) 314.

The Philippine specimens agree in every respect with specimens from Java. Recorded from the Philippine Islands (Zamboanga) by Hebard.[2]

PALAWAN, Puerto Princesa, male and female. MINDANAO, Davao, 1 female.

AMELINÆ

Hystricomantis g. nov. aspera (Stål). Plate 1, fig. 1.

Gonypeta aspera STÅL, Öfvers. Kongl. Vetensk. Ak. Forh. Stockholm No. 10 (1877) 38.

I have no doubt that this is the species very briefly described by Stål. Of the four conical tubercles on vertex the outer ones are much stronger than the median pair; besides these there are two prominent bicuspid tubercles between the bases of antennæ, and likewise a strong tricuspid tubercle near their level at inner margin of eyes. Pronotum strongly keeled, with abrupt rhomboidal dilatation in the middle, spinose at the margins, the median keel and the short keels of the prozone diverging cephalad from the transverse sulcus; anterior coxæ with strong spinose outer and lower keel; anterior femora distinctly longer than coxæ, with concave upper margins, flat outside, with blunt longitudinal keel; tibia short, with two outer and four inner spines, the latter increasing in length toward apex of tibia, the three outer curved; tarsus about twice as long as tibia; middle and hind legs very long and thin; wings reaching far beyond apex of abdomen, hyaline, somewhat infumated, elytra with very narrow costal area, apex washed with brown; some of the veins with dark brown points. The male seems to have been undescribed.

Due to the many striking features of head, thorax, and forelegs, the species deserves to rank as representing a distinct genus of the Gonypetinæ, for which I propose the name *Hystricomantis*. It lacks the ciliation of the costal margin of forewing and the fine denticulation of anterior femora; the antennæ, however, are distinctly ciliated. It is not related to the genus *Myrcinus* as Giglio-Tos suggested, but is related to the Oligonycinæ (*Haania*).[3]

[2] Op. cit. 21.

[3] According to M. Hebard the insect here described is not *Gonypeta aspera* Stål, but a member of the genus *Haania* and possibly *philippina* (Giglio-Tos). It should therefore be listed under Oligonycinæ.—KARNY.

Total length, 20.5 millimeters; pronotum, 5; elytra, 17; anterior femora, 6.5.

LUZON, Mount Maquiling, 1 male.

Hystricomantis dispar sp. nov. Plate 1, fig. 2.

This nice little mantid differs, like the preceding, from all typical Gonypetinæ by having the antennæ but not the anterior wings ciliated and the anterior femora not finely denticulated at the base of the larger spines; head broad, with prominent, round eyes and rectangular frontal scute, the upper side somewhat arched; vertex rounded, with arched upper margin; pronotum short, smooth, distinctly dilated behind the transverse sulcus, metazone about one and a half times as long as prozone, lateral denticulation very fine; abdomen somewhat broader toward end in the female, parallel-sided in the male; anterior coxæ smooth, with very fine spines, the interspace between the two larger ones filled with two very small ones; anterior femora strong, upper margins straight, lower angular; five outer spines, four discoidal spines; tibia strong, with ten outer and twelve inner spines; metatarsus as long as tibia; wings reaching far beyond end of abdomen, perfectly hyaline in the male (in the female the forewings are feebly infumated), costal part strongest; of the hind wings only the apex is brownish, with some darker points. Transverse veins in costal area oblique, nearly parallel, rarely divided; in the discoidal area wide-meshed, many of the transverse veins interrupted, the meshes nearly rectangular; body bright yellowish brown; unicolored in the male, whereas in the female the anterior coxa has a dark reddish brown, transverse band at apex and also one on the anterior femur; basal part of the latter with dark reddish brown longitudinal streaks reaching to discoidal spines; all spines of anterior femora dark at their points.

Length, male, 16 millimeters; female, 17; pronotum, male, 3.5; female, 4; elytra, male, 15; female, 18.

LUZON, Mount Maquiling, male; Mount Banahao, female: Tayabas Province, Malinao, female. MINDANAO, Davao, male.

According to M. Hebard this species is the same as *Amantis aeta* Hebard.[4] According to Karny the female is more intensively colored than the allotype and the color pattern more extensive, as shown by his fig. 2 *a*. As in the meantime I have had occasion to study Hebard's papers here mentioned, I fully agree with this statement.

[4] Op. cit. 31.

Gonypeta borneana Giglio-Tos.

Boll. Soc. Ent. Ital. 46 (1914) Florence (1915) 155.

Compared with specimens of *G. punctata* as defined by Giglio-Tos, from Java and Sumatra, the Philippine specimens distinctly show the specific differences. The granules on pronotum and outer portion of anterior femora are very strong and the coloration is distinctly darker, in one specimen nearly black; only the dimensions are somewhat smaller than indicated by Giglio-Tos.

MINDANAO, Zamboanga, 2 males.

COMPSOMANTINÆ

Compsomantis tumidiceps (Bolivar).

Bolivar, An. Soc. Esp. Hist. Nat. 19 (1890) 303 (*Compsomantis*); Kirby, Ann. & Mag. Nat. Hist. 13 (1904) 83 (*Humbertiella ? brunneri*); Werner, Verh. Zool. bot. Ges. Wien. (1916) 258 (*Hapalomantis*); Giglio-Tos, Boll. Soc. Ent. Ital. 46 (1914) 86; Hebard, Proc. Acad. Nat. Sci. Philadelphia 72 (1920) 36.

This species was first described from the Philippines, but occurs also on Lombok and Sumbawa Islands (*Kirby, Werner*). The present specimen differs slightly from a female from Lombok, in my collection, by a somewhat longer pronotum, probably owing to its sex. There is no doubt that Giglio-Tos is perfectly right in uniting this species with *Compsomantis crassiceps* De Haan and *Hapalomantis rufula* Westwood in the same group; the union seems very natural.

LUZON, Mount Maquiling, 1 specimen (probably a male, end of abdomen missing).

THESPINÆ

Euchomenella heteroptera (De Haan).

Bijdr. Kenn. Orth. p. 78, pl. 18, fig. 1; Saussure, Mem. Soc. Gen. 21 (1871) 48; Giglio-Tos, Boll. Soc. Ent. Ital. 47 (1915) 34, 35.

This species seems not to have been found previously in the Philippine Islands, where only the rather closely related *Tagalomantis manillensis* Sauss. is known. It is easily distinguished from that species by its unicolorous, infumated wings. The specimen agrees perfectly with De Haan's figure, whereas the species figured as the female belongs, as Giglio-Tos has already pointed out, to quite another genus, called *Mythomantis* by that author. I have a specimen of the latter insect, *M. confusa* Westwood, from Java, that agrees in every respect with De Haan's figure.

LUZON, Tayabas Province, Malinao, 1 male.

CALIRIDINÆ

Leptomantis lactea (Saussure).

Miopteryx lactea SAUSSURE, Mem. Soc. Gen. 21 (1871) 125.

LUZON, Laguna Province, Mount Maquiling, 1 female.

Aetella bakeri Hebard.

Proc. Acad. Nat. Sci. Philadelphia 72 (1920) 45.

I had at first confounded this species with *Leptomantis albella* Burm.; but, after having received Hebard's excellent paper, I am convinced that I had before me the new species described by him as representing a new genus. This species cannot be rare and, in any case, it appears to be widely distributed over the Philippines. It is easily distinguishable from *Leptomantis lactea* by the smaller size and the perfectly hyaline, iridescent wings, whereas that species has distinctly milky wings with white costal margin on elytræ. A pair of dark spots, apparently common in *L. lactea,* is not frequently to be found in *Aetella bakeri* on the metazone of the pronotum, as far behind the transverse sulcus as the length of the prozone.

LUZON, Laguna Province, Mount Maquiling, 1 female, and Los Baños. BASILAN, 1 male. MINDANAO, Zamboanga, 1 female: Butuan and Dapitan.

DEROPLATINÆ

Deropletys philippinica sp. nov.

Distinguished from all other members of the genus by the narrower pronotum, resembling somewhat in shape that of *Sphodrepoda medioconstricta* Wood-Mason. Prozone of pronotum one-third the length of metazone, the latter with a longitudinal median keel in its posterior half. The expanded part of the prozone is not more than half the transverse diameter of the prozone itself, narrowed cephalad and with rounded anterior margin; in its anterior third the metazone is parallel-sided, widens toward its second third, and is again narrowed to its posterior end, thus forming a sinuous line on each side; wings extending much beyond apex of abdomen, the anterior ones feebly dilated toward apex, which is bluntly triangular; costal area dilated only at base, the greater portion toward the apex very narrow; stigma distinct, small, triangular; hind wings with the costal area angularly produced (more so than the fore-wings); middle and hind legs very slender, with small, triangular, somewhat denticulated lobules near apices of tibiæ; exposed parts dead-leaf-colored above and below; inner face of

anterior femora with a large blackish spot before and somewhat behind the unguicular sulcus, and three dark vertical streaks toward apex, hind wings with a light yellowish brown spot before apex which is rather dark brown, like the base, and indistinctly dark spotted; anal area with lighter transverse veins; anterior wings indistinctly mottled with darker and lighter brown; middle and hind legs broadly banded with dark brown.

MINDANAO, Davao, 1 male.

Total length, 42 millimeters; pronotum, length, 15; breadth at broadest part of dilatation, 4; forewings, length, 30; breadth, 7.

MANTINÆ

Tenodera aridifolia Stoll.

Giglio-Tos, Boll. Soc. Ent. Ital. 1911 **43** (1912) 37; Hebard, Proc. Acad. Nat. Sci. Philadelphia **72** (1920) 50.

LUZON, Mount Maquiling, 2 males. MINDANAO, Iligan; Davao, 1 female, large specimen, 10 centimeters.

The Iligan specimen is somewhat darker brown, with a median longitudinal line on the pronotum. Curiously enough, this widely spread species seems not to have been found before in the Philippines.

Tenodera fasciata Olivier = **attenuata** Stoll.

Giglio-Tos, Boll. Soc. Ent. Ital. 1911 **43** (1912) 45; Hebard, Proc. Acad. Nat. Sci. Philadelphia **72** (1920) 51.

Apparently new for the Philippines.

MINDANAO, Zamboanga, 1 male.

Hierodula vitrea (Stoll).

Giglio-Tos, Mant. Esot. **5** (1912) 83.

Spines of anterior coxæ very blunt, scarcely distinguishable.

Not recorded before from the Philippine Islands.

LUZON, Mount Maquiling, 1 male.

Hierodula gigliotosi sp. nov.

Frontal scutellum pentagonal, with parallel lateral and straight anterior sides and two feeble longitudinal keels, somewhat broader than high; pronotum elongate, its metazone more than twice as long as the prozone; lateral margins very feebly denticulated at the dilatation; posterior angles and margin rounded, blackish; organs of flight extending beyond end of body, elytra with opaque, bright green costal and perfectly hyaline discoidal part; hind wings perfectly hyaline; of the internal spines of anterior femora the first (from apex) and fourth are quite black, the sixth likewise black with a black spot

at base; the eighth, tenth, twelth, and fourteenth have only the base black; internal spines of tibiæ black at their tips, discoidal spines black at their bases; all other parts green; subgenital plate elongate, darker green.

Total length, 47 millimeters; pronotum, 16; anterior wings, 32.

MINDANAO, 1 male.

This species is characterized by the absolute lack of spines on anterior coxæ, as is normally the case in the males of the genus *Ephierodula* Giglio-Tos; otherwise it is a true *Hierodula*, closely related to *H. unimaculata* Oliv. from Coromandel, Bombay, and Tonkin.

Hierodula patellifera Serv.

Giglio-Tos, Boll. Soc. Ent. Ital. 1911 43 (1912) 95.

LUZON, Mount Maquiling, a female; Los Baños, male and female.

The Los Baños female is of the green variety, the two others, of the grayish. The species has already been recorded from the Philippines, from Luzon, by Giglio-Tos. Hebard also records it from various localities in the Philippines.

Ephierodula immaculifemorata sp. nov.

This fine species differs from both other species of the genus [5] by the unicolorous anterior coxæ and femora and by the denticulated anterior coxæ of the male; but in all other respects it is a true *Ephierodula*. Frontal scute pentagonal, with rounded anterior edges; pronotum not denticulated laterally; metazone about three times as long as prozone; dilatation strong, well distinguished by a horizontal expansion of its margin, resembling somewhat the still stronger one of *Rhomboderula tamolana* Brancs [6] from New Guinea; wings extending much beyond end of abdomen; forewings with opaque green costal and glossy, hyaline discoidal part; stigma broadly surrounded by dark brown; hind wings hyaline, infumated; anterior coxæ with eight feeble spines; anterior femora with four outer and fifteen inner spines; eleven outer and fifteen inner tibial spines.

Total length, 65 millimeters; pronotum, 22; elytra, 50.

MINDANAO, Butuan, a male.

Rhombodera ornatipes sp. nov. Plate 1, fig. 3.

This fine new species is one of the group to which *Rhombodera major* belongs, characterized by Giglio-Tos as having the meta-

[5] Cf. Werner, Verh. Zool. bot. Ges. Wien (1916) 262 and 263.
[6] Jahresb. Ver. Trencsin. Cour. 19–20 (1897) 62, pl. 1, fig. 8.

zone of the pronotum at least two and a half times as long as the prozone, and the broadest part of the pronotum before its middle. It is, however, easily distinguished from all other members of this group by the coloration of the inner side of the anterior coxæ, which are deep and shining black on their apical half; also, the trochanter and a large spot at the basal hind quarter of the inner side of anterior femora are black, and there are several (about five) small black spots at the base of the inner femoral spines; the large femoral spots contain two whitish ones; the others are green; coxal spines small, irregular; outer femoral spines four, inner sixteen, the first (from apex), fourth, sixth, an eighth black, with a black spot at their bases; wings reaching to end of abdomen, anterior ones with opaque green costal, and hyaline discoidal areas; stigma small, elongate.

Total length, 49 millimeters; length of pronotum, 15; broadest part of pronotum, 6.5; length of forewings, 32.

LUZON, Mountain Province, Baguio, a male.

ARCHIMANTINÆ

Statilia haani (Saussure)[7] **var. major var. nov.**

Similar to the typical form of this common, widespread species, which has been previously recorded from the Philippine Islands by Saussure and by Brunner, but larger. It is also represented in my collection, by specimens from Samar and Mindoro. One female from Mount Maquiling is much larger and distinctly darker than the other, and the wings do not reach end of body, but otherwise it is not different.

LUZON, Laguna Province, Mount Maquiling, 2 males and 2 females; Los Baños, 1 male.

Statilia pallida sp. nov.[8]

This species differs from the preceding (it also has the dark postacetabular prosternal spot) by the uniformly colored inner side of anterior femora. I have examined large numbers of *S. haani* from Sikkim, Annam, Penang, Perak, Sumatra, Nias, Java, Lombok, Ceram, Formosa, and Japan; and, as the coloration of mantids generally, and of *S. haani* especially, is fairly constant, the specific separation of these two specimens

[7] Giglio-Tos, Boll. Soc. Ent. Ital. 1911 43 (1912) 6.

[8] According to M. Hebard this and the preceding species are *Statilia maculata*. Hebard says (in litt.): "The cephalic limb coloration is no specific criterion and is subject to decided variation."—KARNY.

Having examined more material in the meanwhile, I agree with Hebard's opinion.—WERNER.

seems to be justifiable. Color pale greenish; size about the same as the preceding species.

LUZON, Laguna Province, Mount Maquiling, a male; Los Baños, a male.

Statilia nemoralis (Saussure).

Giglio-Tos, Boll. Soc. Ent. Ital. 1911 43 (1912) 8.

Differs from *S. haani* by the shorter thorax without any trace of dark postacetabular prosternal band, the larger and more mesially situated dark band of anterior coxæ (on the base of coxæ in *S. haani*), by the broad dark band in the middle of anterior femora, and by the indistinctly margined stigma. The present specimen has the alæ not tessellated, as is the case in var. *infuscata* Giglio-Tos.

PALAWAN, Puerto Princesa, a male.

ACROMANTINÆ

Acromantis hesione Stål.

Öfvers. Kongl. Vetensk. Ak. Forh. No. 10 (1877) 38. Hebard, Proc. Acad. Nat. Sci. Philadelphia 72 (1920) 73.

Costal margin of forewings bright green, hind wings yellowish, infumated at apex; otherwise pale reddish brown; outside of anterior femora darker, broadly trifasciated.

I at first took this species for *A. javana* Giglio-Tos, poorly described as the above-mentioned species. Besides, the specific name *javana* is preoccupied by *Acromantis javana* Sauss., which is an *Odontomantis*. The name must therefore be changed, and I propose **Acromantis lilii**, in honor of that great student of the Mantidæ, whose name "Giglio" means "lily."

Total length, male, 22 millimeters; forewings, 17; female, about 27.

LUZON, Laguna Province, Los Baños, male and female.

Acromantis luzonica Hebard.

Proc. Acad. Nat. Sci. Philadelphia 72 (1920) 71.

Resembles much a female of the Neotropical *Phyllovates parallela* (De Haan) in form and coloration of the wings, the anterior wings being grass green, the costal area bent down at a distinct angle, the discoidal area with an oblique dark spot; posterior wings yellow. Here we have another case of similarity between the Ethiopian *Calidomantis savignyi* Sauss. and the Neotropical *Parastagmatoptera flavoguttata* Serv.

LUZON, Mountain Province, Baguio, 2 females.

Phyllothelys bakeri sp. nov.

Near *Phyllothelys westwoodi* Wood-Mason, but with the spines of anterior coxæ minute, and the lateral denticulation of pronotum very weak; anterior femora less slender and not fasciated, lobes of intermediate and posterior femora strongly undulated. Elytra distinctly hyaline on their discoidal portion, veins alternately spotted dark and white, apex with brown spots, as also the hind wings, which are more distinctly infumated than the elytra. It is possible that this species may be identical with *P. decipiens* Giglio-Tos, but, as the number of coxal spines is greater (fifteen) and the author says nothing about the lobes of the middle and hind legs, the identification remains doubtful.

Total length, 39 millimeters; pronotum, 14.5; forewings, 23; anterior coxæ, 9; anterior femora, 9.5.

This new and interesting species is named after its zealous and successful discoverer, Prof. C. F. Baker.

LUZON, Laguna Province, Mount Maquiling, a male.

Possibly the males figured by Wood-Mason and Westwood as *Phyllothelys westwoodi* belong to two different species. The horn of the vertex in the figure by Westwood [9] is distinctly shorter, the pronotum laterally densely spinose, the anterior femora slenderer, and the lobes of the hind leg more denticulated.

HYMENOPODINÆ

Odontomantis javana (Saussure).

Mem. Soc. Gen. 21 (1879) 33, pl. 4, fig. 11. Hebard, Proc. Acad. Nat. Sci. Philadelphia 72 (1920) 77.

I can find no difference between these specimens and those from Java in my collection, nor can I detect any reason for separating *Odontomantis euphrosyne* Stål from this species.[10]

LUZON, Laguna Province, Mount Maquiling, 1 female: Nueva Vizcaya Province, Imugan, 1 female. PALAWAN, Puerto Princesa, 1 male. MINDANAO, Davao, 1 female.

Creobroter urbana (Fabricius).

Saussure, Mem. Soc. Gen. 21 (1871) 144.

Ground color of elytra darker green, the ocelliform spot more yellowish (not reddish).

[9] Rev. Ins. Fam. Mant., London (1889) pl. 1, fig. 3.

[10] M. Hebard says (in litt.): "Werner has apparently not noted the differences which at least warrant geographic racial recognition."—KARNY.

LUZON, Mount Banahao, a female, quite typical: Mount Limay, a female.

I have in my collection specimens from Java, Annam, Tonkin, and Siam, as well as some from Ceylon; from the last-named locality only *C. pictipennis* Wood-Mason seems to be recorded, and I have seen a specimen from Celebes (leg. *Sarasin*). I am unable to find any characters distinctive from those of *Creobroter meleagris* Stål.

ILLUSTRATION

Plate 1

Fig. 1. *Hystricomantis aspera* (Stål). *a*, head and pronotum, from above; *b*, head, front view; *c*, head, from above; *d*, fore parts, from side.
2. *Hystricomantis dispar* sp. nov. *a*, anterior leg of female; *b*, anterior wing of male.
3. *Rhombodera ornatipes* sp. nov. Antreior leg, inner side.

ADDITIONS TO THE HERPETOLOGICAL FAUNA OF THE PHILIPPINE ISLANDS, I

By EDWARD H. TAYLOR

Of Manila, Philippine Islands

SEVEN PLATES

New and rare frogs, lizards, and snakes have been found during recent herpetological collecting in parts of the Philippines. Although these collections were made prior to the actual publication of my monographs,[1] the descriptions could not be included therein because those books were in type. For this reason papers on these new collections will be published in the Philippine Journal of Science, of which the present is the first. The following notes from my field books show where the chief collections were made and collecting dates:

NORTHERN LUZON

I returned to the Philippine Islands from the United States in 1920 and arrived at Manila on March 30. On April 11, I proceeded to Baguio where I joined Prof. H. Otley Beyer and Dr. Robert L. Schofield.

April 12. Specimens of *Kaloula rigida* sp. nov., *Rana luzonensis*, and *Sphenomorphus jagori* were collected near Baguio.

April 13. Our party left Baguio for the north, going by automobile to kilometer 14. Here I collected a few specimens of *Polypedates leucomystax*, *Rana luzonensis*, and *Rana magna*. We reached camp 30 in the evening.

April 14. An adult specimen of *Oxyrhabdium leporinum* was collected.

April 15. The day was spent in the vicinity of Haight's place, Pauai, but no reptile or amphibian was seen or heard. Mr. Haight said that frogs were occasionally seen.

April 16. Collecting along the trail between Haight's and camp 88 yielded neither amphibian nor reptile.

April 17. A specimen of *Cornufer subterrestris* was collected at kilometer 101. Professor Beyer left for Cervantes.

April 18. A specimen of *Peropus mutilatus* was taken in the presidencia of Subangan. Specimens of a *Mabuya* were shot near the trail.

[1] Amphibians and turtles of the Philippine Islands, Bureau of Science publication 15 [reprint from Philip. Journ. Sci.]. Manila (1921) 193 pp., 17 pls., 9 text figs. Snakes of the Philippine Islands, Bureau of Science publication 16. Manila (1922) 312 pp., 37 pls., 32 text figs. Lizards of the Philippine Islands, Bureau of Science publication 17. Manila (1922) 262 pp., 23 pls., 53 text figs., in press.

April 19 and 20. I collected in the vicinity of Bontoc and was disappointed because of the few specimens found. Doctor Schofield saw a turtle in the market, but it had disappeared before I could get it.

April 21. I left Doctor Schofield at Bontoc and set out for Balbalan, Kalinga.

April 23. Near Balbalan I found a specimen of *Hologerrhum philippinum*. I purchased a specimen of the mammal *Phloeomys pallidus*.

April 23. Near Balbalan I found a specimen of *Hologerrhum philip-* and as a result amphibians began to breed. I collected large series of several species, some of which are new.

May 2 and 3. Balbalan to Bontoc. Very few specimens were collected.

May 5. I climbed Polis Mountain.

May 6. I arrived at Banaue.

May 7. Banaue to Kiangan. Amphibians were heard at night near Kiangan, but I was unable to collect any of them. Two young specimens of *Elaphe erythrura* were collected along the trail.

May 8. Kiangan to Nayon.

May 9 to 12. I collected *Kaloula picta* and several of the commoner lizards in this vicinity.

May 13. Nayon to Kiangan.

May 14. Kiangan to Tauang.

May 15. Tauang to Manhuyhuy. A small frog, probably *Cornufer meyeri*, was found dead near the trail.

May 16. Manhuyhuy to camp 59. Between kilometers 65 and 64 a large red frog jumped into the trail in front of me and from there into the cañon. This frog appeared to be an unknown species of *Rana*. The elevation at this place is about 2,500 meters. No frog has been recorded from so high an elevation in the Philippines.

May 17. Camp 59 to Baguio.

MANILA AND VICINITY

During May and June, 1920, I made numerous trips about Manila, to Mount Maquiling, and to Mount Banahao.

POLILLO AND CALOTCOT ISLANDS

July 8. I left Manila by rail for Hondagua where I took the steamer for Polillo.

July 9. I arrived at Polillo.

July 10 to 23. In the vicinity of the town of Polillo, I collected numerous specimens.

July 24. I went to Burdeos on the east coast of the island. A snake, probably a species of *Natrix*, was seen on the trail, but I was unable to capture it.

July 25 to 27. Some interesting specimens, including *Rana merrilli* sp. nov. and *Typhlops cumingii* (Gray), were collected near Burdeos.

July 27. I embarked in a small banca for Calotcot Island, which is about 25 kilometers east of Polillo.

July 28 to August 1. Calotcot Island is about 3 kilometers long and is heavily forested. There is a small clearing at the southern end. Eleven species of lizards and three species of snakes were taken on this island. No amphibians were seen. I returned to Burdeos during the night of August 1.

August 2 and 3. I collected at Burdeos.
August 4. I returned to the town of Polillo.
August 5 to 10. I collected in the vicinity of Polillo.
August 11. I went to Bislian in the southern part of the island. There I found several new species.
August 12. I returned to Polillo.
August 13. I left Polillo.
August 14. I arrived in Manila.

MINDANAO

September 23 to October 6. During this period I collected in the southern part of Zamboanga Peninsula, for the most part in the mountains along Tumugao River, including a two days' journey from the waterworks' intake. Only a few species were found. One specimen of the rare black and yellow cobra, *Naja samarensis*, and three or four frogs of undescribed species were collected.

BASILAN

October 7. I collected in the vicinity of Isabela. Through the kindness of Mr. Guy Holland, a lumberman of Isabela, I was taken by launch to Port Holland, the site of a sawmill on the western coast directly opposite Great Govenen and Little Govenen Islands.[2] I had visited this point in 1917 and had found several interesting specimens. At that time primeval forest covered the sites.

October 8 to 14. Port Holland. I found *Polypedates pardalis* and *Polypedates appendiculatus* while collecting at night. A good breeding series of *Kalophrynus stellatus* was taken. While here I was very kindly entertained by Mr. Hamilton, the sawmill manager, who facilitated my collecting in no small degree.

October 15 to 23. Abung-abung. Thanks to the kindness of Mr. Hamilton and Mr. Holland, I was enabled to visit a logging camp on the southern part of the island. It was an ideal collecting ground, and many specimens and species were taken, some of them unknown to me. A cæcilian differing from *Ichthyophis weberi* was discovered and four specimens were taken. I had splendid success collecting at night. Returned to Isabela on the 23d and left for Zamboanga the same day, embarking there for Jolo on October 24, 1920.

JOLO

October 25 to November 16. This period was spent in making collections in the western half of Jolo. Visits were made to Mount Tumangis, Bud Daho, Indanan, Camp Romandier, and a point near the central part of the island where the Government cattle ranch is situated. I am under great obligation to Capt. Francis Link, formerly of the Philippine Constabulary, who accompanied me on many of my trips. A specimen of the rare *Luperosaurus joloensis* was seen, but it escaped in a tall tree.

November 17. I sailed for Manila.

[2] The spelling of these names is that on Coast and Geodetic Survey maps. They are called Gouenan by the Yakans and Samals of the district.

MOUNT MARIVELES

December 26, 1920, to January 1, 1921. I collected on the northern side of Mount Mariveles. Two specimens of the rare *Hologerrhum philippinum* were taken, but nothing else that was noteworthy.

MOUNT MAQUILING

April 15 to June 1. During this period extensive collections were made on Mount Maquiling. A specimen of *Oxyrhabdium*, which is distinct from the two recognized forms, was taken, but it escaped from a faulty collecting bag.

Aside from collections made by myself I have obtained small collections from southern Leyte, Sibuyan, Romblon, Batan Island, Busuanga, and Balabac.

In this paper the following species are described as new:

AMPHIBIANS

Rana merrilli.
Cornufer cornutus.
Philautus polillensis.
Philautus williamsi.
Philautus zamboangensis.
Philautus basilanensis.
Kaloula negrosensis.
Kaloula kalingensis.
Kaloula rigida.
Bufo mcgregori.

LIZARDS

Gekko porosus.
Gekko smaragdinus.
Sphenomorphus bakeri.
Siaphos herrei.

SNAKES

Dryocalamus mccroryi.
Calamaria joloensis.
Pseudorhabdium minutum.
Typhlogeophis ater.

The following rare or little-known species are discussed:

Rana everetti Boulenger.
Megalophrys hasselti (Tschudi).
Ptychozoon intermedia Taylor.
Draco mindanensis Stejneger.
Typhlops cumingii (Gray).
Typhlops suluensis Taylor.
Haplonodon philippinensis Griffin.
Hologerrhum philippinum Günther.
Calamaria grayi Günther.

Rana merrilli sp. nov.

Type.—No. F876, E. H. Taylor collection; collected at Burdeos, Polillo Island, July 27, 1920, by E. H. Taylor.

Description of type.—Choanæ large, very widely separated, partially hidden by overhanging jaw; vomerine teeth in two small oval groups, lying between the choanæ and barely extending back as far as posterior edge of choanæ, separated from choanæ by a distance nearly as great as that between the two groups; tongue large, deeply bifurcated, the horns rounded at their tips; head much flattened; snout moderately

long, extending beyond lower lip; distance of nostril from eye double its distance from tip of snout; distance between nostrils less than interorbital distance, which is distinctly greater than width of upper eyelid; diameter of eye about equal to its distance from nostril; tympanum very large and distinct, its diameter about four-fifths of eye and equal to the interorbital distance; loreal region slightly concave, perpendicular for some distance, then sloping abruptly to lip; canthus rostralis moderately distinct, rather rounded on edge; angle of mouth with a short glandular fold extending to behind tympanum, and another short fold above insertion of arm; distinct narrow dorsolateral folds begin behind eyes and continue dorsolaterally to end of body, converging slightly; upper eyelid without tubercles; skin finely shagreened above; chin, throat, and breast entirely smooth; belly and underside of femur distinctly granulate; below anus two strong elongate glandular tubercles narrowly separated; three outer fingers with strongly widened, rounding disks on tips; inner with small, scarcely widened disks; first finger much shorter than second which is only slightly shorter than fourth; subarticular tubercles strongly developed; three strong carpal tubercles, with a few smaller tubercles scattered over palm; toes with smaller, rather pointed disks; the web between toes extends to base of disks on outer side of first, second, and third toes and on inner side of fifth toe, on inner side of second and third toes to near the disk by a very narrow margin, and to the penultimate joint of fourth; subarticular tubercles moderately distinct; a small inner metatarsal tubercle and a still smaller outer tubercle; hind limb brought forward the tibiotarsal articulation reaches between eye and nostril.

Color in life.—Above uniform olive green to lighter green on sides. No spots or markings; no bars on limbs; upper part of loreal region darker olive; a black spot immediately in front of tympanum below eye and another behind tympanum; a small yellow area behind eye and another covering angle of mouth; below greenish yellow to cream with olive spots; dorsolateral glandular folds lighter than body and a slightly darker olive line below them.

Variation.—The cotype, from the same immediate locality, agrees in detail with the type save that the tympanum is somewhat larger proportionately and the belly immaculate. I find no vocal sacs in either specimen. The specimens are probably females.

Measurements of Rana merrilli sp. nov.

	No. F876, type.	No. F876A, cotype.
	mm.	*mm.*
Snout to vent	33.5	39.0
Width of head	11.0	12.2
Length of head	14.0	16.0
Depth of snout in front of eye	3.0	3.5
Depth of head, at tympanum	4.0	5.0
Length of snout	5.5	6.0
Eye to nostril	4.8	4.5
Diameter of eye	4.4	4.3
Diameter of tympanum	3.8	4.0
Forelimb	22.0	26.0
Width of disk	2.0	2.0
Longest finger	12.0	13.2
Hind limb	60.0	64.0
Femur	18.0	19.0
Tibia	20.0	22.0
Longest toe, to metatarsal tubercle	16.5	17.0

Remarks.—This species is differentiated from other Philippine species of *Rana* by the very much-flattened head, the very large tympanum, and the presence of the two transverse glandular folds, or tubercles, below the anus. Specimens were discovered seated on the leaves of *Pandanus* trees which extended over a pool of water in an old stream bed. Two other specimens observed, one in the forest, the other in the same locality, escaped. The species is named for my esteemed friend Elmer D. Merrill, director and botanist of the Bureau of Science, Manila.

Rana everetti Boulenger.

Rana everetti BOULENGER, Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 72, pl. 6; TAYLOR, Amphibians and Turtles of the Philippine Islands (1921) 63, pl. 6, figs. 1, 1*a*, 1*b*.

A large specimen of this rare species was taken at Pasananka, near Zamboanga. It was found in a rain pool near the small park and water reservoir. The specimen agrees in detail with Boulenger's admirable figure and description. The dorsolateral glandular fold is dim, but it can be traced for two-thirds the length of the body. While not mentioned in the description, Boulenger's figure shows a tubercle between the shoulders slightly to the right of the median line. My specimen has a well-developed, conspicuous tubercle in the same place. The specimen is probably a female and consequently without vocal sacs.

Measurements of Rana everetti Boulenger.

	mm.
Snout to vent	80.0
Length of head, to angle of jaw	32.0
Width of head, at tympanum	26.0
Diameter of eye	9.1
Diameter of tympanum	7.0
Eye to end of snout	13.0
Eye to nostril	8.0
Upper eyelid	7.5
Interorbital distance	7.5
Forelimb	44.0
Longest finger with hand	25.0
Hind limb	140.0
Femur	42.0
Tibia	46.0
Longest toe, to metatarsal tubercle	35.0
Widest disk on forefoot	4.5

Remarks.—The webbing on the foot reaches the disks by a very narrow margin on the inner side of the second and third toes, and does not extend beyond the outer subarticular tubercle of the fourth. The species appears to be rare, since only this single specimen was found in the course of one month's intensive collecting.

Philautus williamsi sp. nov.

Type.—No. 356, E. H. Taylor collection; collected on Polillo Island, August 12, 1920, by E. H. Taylor.

Description of type.—Choanæ moderately large, widely separated, not concealed by overhanging jaw; vomerine teeth wanting; tongue moderate with two broad rounded horns posteriorly, separated narrowly at base; no tubercle present; head very broad, nearly equal to one-half the length of body; eye large, the diameter of orbit equal to the length of snout; the width of upper eyelid equal to interorbital distance; snout short, ending in a very small conical projection; area about nostrils slightly raised and projecting with a depression between them; upper part of loreal region nearly perpendicular, lower part sloping obliquely to mouth; a distinct depression in front of eye not extending to nostril; tympanum small, indistinct, covered with skin, its diameter about equal to one-third that of eye; a strong fold from eye across upper part of tympanum to insertion of arm; a slight curved fold crossing angle of mouth; skin of body minutely corrugated; head with scattered tubercles, one or two tubercles on upper eyelid, two tubercles behind the eyes, the posterior largest with another pair of dim tubercles in middle

of back; these tubercles connected with the anterior pair by a very dim fold; tibia with indistinct tubercles; skin of throat slightly corrugated; belly, breast, underside of forearm, and femur strongly granulate; fingers with widened disks, the two outer much larger; those of the two inner fingers small, and partially opposed to the other two; subarticular tubercles large, rounded, well defined; carpal tubercles ill defined; toes with pads slightly smaller than those on fingers, one-third to one-half webbed; subarticular tubercles moderately distinct; a wavy skin fold on outer side of fifth toe and part of foot; inner metatarsal tubercle distinct, large, flattened; outer, if present, very indistinct; the tibiotarsal articulation brought forward reaches just beyond tip of snout.

Color in life.—Above yellow-brown with markings of darker brown; upper eyelid black; snout and upper part of loreal region dark brown; two light areas behind eyes; a large regular brown spot beginning on shoulders, forking in the middle of the back, is continued to groin; area between branches only slightly lighter than the branches; one broad brown bar across femur and tibia and another narrow outer one; lower part of tibia and inner part of foot pure white; posterior aspect of femur nearly white with slight marbling of brown; second tubercle behind eyes very dark; edge of upper jaw somewhat lighter than lores, and a dim light cream spot below and somewhat behind eye; throat, breast, belly, underside of arm, fingers, foot, toes, and web between toes strongly powdered with cinnamon brown; two inner fingers immaculate.

Measurements of the type and the cotype of Philautus williamsi sp. nov.

	No. 356, type.	No. 357, cotype.
	mm.	*mm.*
Snout to vent	21	22
Length of head	9	9.6
Width of head	10	10
Depth of head	4.5	5
Forelimb	12.8	13.5
Longest finger	6.8	6.3
Hind limb	40	38
Longest toe, to metatarsal tubercle	9.6	9.5
Diameter of eye	4	4
Length of snout	4	4

Variation.—There is considerable variation both in markings and in the distribution of tubercles on the head and back of the four cotypes. The prominent black tubercle some

distance behind the eye is present in all the specimens, but the narrow fold behind it is not so evident. Some of the specimens have numerous tubercles between the eyes and on the snout; in others they are largely wanting. Specimen 356 shows no characteristic mark on the back. I find no vocal sacs in any of the specimens.

Remarks.—The type and three cotypes were collected in southern Polillo along the trail between Polillo and Bislian at a point near where the trail crosses the low divide. A single specimen was collected by Dr. F. X. Williams in mountains near Mauban, Tayabas, on the eastern coast of Luzon. This specimen is rather different in color and markings, but there are no structural differences save those that may be accounted for by the state of preservation. The species is named for Dr. F. X. Williams, of the Hawaiian Sugar Planters' Association, who collected the Luzon specimen. I believe that this is the first record of a species of *Philautus* for Luzon.

Philautus basilanensis sp. nov.

Type.—No. 1510, E. H. Taylor collection; collected at Abungabung, Basilan, October 15, 1920, by E. H. Taylor.

Description of type.—Choanæ small, widely separated, not concealed by overhanging jaw; tongue narrow, elongate, nicked behind; a slight, rounded tubercle on anterior part of tongue; openings of vocal sacs small, near angle of mouth; snout moderate, pointed, ending in a blunt conical point; canthus rostralis distinct, slightly rounded; loreal region perpendicular for a short distance, then sloping obliquely to edge of lip; nostrils forming raised prominences on snout, much nearer tip of snout than eye; diameter of eye equal to length of snout; eyes prominent, the upper lids equal to interorbital distance; tympanum small, indistinct, covered with skin, not more than one-third diameter of eye; a straight supratympanic fold from eye to insertion of arm; skin of body and limbs very strongly granular, intermixed with larger tubercles; tubercles on head and shoulders arranged in more or less regular lines crossing eyelid and continuing on shoulders; tubercles on femur and tibia arranged in transverse lines; numerous tubercles on eyelids, one more prominent than the others; skin on belly entirely covered with strong mosaiclike granules; lower jaw with a series of glandular tubercles around edge, with a prominent tubercle at tip of lower jaw; tips of digits of hand strongly dilated, those of the two outer fingers double the width of digit; those of the two inner fingers smaller and somewhat opposed to the two outer; sub-

articular tubercles well defined; sole with fine granules; underside of forearm with two or three enlarged tubercles; no trace of web between fingers; toes with enlarged disks at tips, slightly smaller than those on fingers; toes about one-third webbed; subarticular tubercles prominent; undersurface of foot and digits strongly granular; a prominent inner metatarsal tubercle; outer tubercle, if present, not distinguishable from numerous tubercles on sole of foot, which continue to heel; underside of tibia without granules; the leg being brought forward, the tibiotarsal articulation reaches beyond tip of snout.

Color in life.—Above reddish brown, variegated with lighter and darker areas but no distinct markings; tips of larger tubercles yellow; tip of snout lighter brown than body; lores dark; belly white to gray; the two inner fingers bright yellow; edge of upper and lower lips yellow; tubercles on lower jaw yellow; underside of hand yellow to cream, of foot reddish brown.

Measurements of the type and the cotype of Philautus basilanensis sp. nov.

	No. 1510, type.	No. 1699A, cotype.
	mm.	*mm.*
Length, snout to vent	21	22
Width of head, at tympanum	9	8
Depth of head, at tympanum	6.6	6
Length of head, to posterior edge of tympanum	9	9
Diameter of eye	4	4
Length of snout from eye	4	4.1
Forelimb	11.5	12
Longest finger	6	6
Hind limb	38	37
Longest toe, from metatarsal tubercle	9.5	9

Variation.—Two cotypes, taken in the same immediate locality, vary little in essential characters; the granulation is not so strongly defined in either of the other specimens collected. No. 1699A has two rather strong tubercles between the eyes, which are but dimly suggested in the type. No. 1269B is light lavender-brown. A distinct black area lies between the eyes and involves part of the upper lids. A few scattered black spots are between the shoulders. Two large elongate spots are present on each side of the back. The limbs are strongly barred with reddish brown. This specimen has suffered an injury which has destroyed the side of the head and one forelimb.

Remarks.—The species appears to be related to *Philautus woodi* Stejneger, but differs in the size and arrangement of the

tubercles on back and limbs, and the greater extent of webbing between the toes. Numerous other differences are evident on a comparison of the descriptions.

Specimens were captured at night by following in the direction of their shrill chirping cry, which for a long time was believed to come from some species of cricket. They were located with great difficulty, perched on the leaves of low shrubs. A few other voices were heard, but these sounds came from a swamp overgrown with thick jungle through which one dared not venture at night.

Philautus polillensis sp. nov.

Type.—No. 351, E. H. Taylor collection; collected near the southern end of Polillo Island, July 12, 1920, by E. H. Taylor.

Description of type.—Head about as wide as body, pointed; tongue moderately long with two short horns, narrowly separated at base; choanæ small, widely separated; vomerine teeth in two small rows, considerably behind the choanæ, separated from each other by a distance one and a half times the length of one of the groups; tongue with a raised moundlike prominence near anterior part; tip of snout conical; nostrils much nearer tip of snout than eye; diameter of orbit somewhat less than length of snout; a single large conical tubercle on upper eyelid near outer middle edge; pupil horizontal; canthus rostralis distinct; loreal region concave, sloping gently to edge of jaw; tympanum rather indistinct, its diameter one-third to one-fourth of eye; a strong fold above tympanum to near insertion of arm dimly granular; a second fold from a point above and behind tympanum to lower jaw; a row of granules from behind tympanum to arm, parallel to the supratemporal fold; a distinct depression between the two folds; skin above practically smooth, with two small tubercles between shoulders and two pairs on back; a small tubercle on back above anus; a distinct tubercle on tip of jaw; skin of throat and breast smooth, with numerous minute pitlike depressions; belly and underside of femur strongly granular; a strong tubercle at heel; tip of each of the three outer fingers with a strongly dilated pad, nearly twice the width of digit; inner finger very small, slender, without pad; subarticular tubercles large, flat, moderately well defined; a single large carpal tubercle; no trace of web; tips of toes distinctly dilated, not more than one and one-half times the width of digit; fourth toe very long, third and fifth equal, barely reaching third subarticular tubercle from the

disk on fourth toe; inner metatarsal tubercle rather large but ill defined; outer small, dim; leg brought forward, the tibiotarsal articulation reaches about halfway between eye and nostril.

Color in life.—Above creamy white to yellow, slightly pigmented with minute dots of cinnamon brown; a bar of cinnamon between eyes and dim spots about the dorsal tubercles; upper eyelids dark gray to blackish; spots on outer digits of all limbs; dim bars on tibia and femur; chin and throat yellow with very sparse peppering of brown; underside of hand and belly immaculate; underside of leg and foot strongly peppered with brown.

Measurements of the type of Philautus polillensis sp. nov.

	mm.
Snout to vent	27
Length of head, to angle of jaw	11
Width of head, greatest	10
Diameter of eye	4
Length of snout	4.5
Forelimb	16.3
Longest finger, from wrist	7
Hind limb	42.5
Tibia	14.2
Longest toe, from metatarsal tubercle	11.2

Variation.—There are seven cotypes in the collection, all taken in the same immediate locality. These vary more or less in markings, but the coloration is identical. No. 349 (22.5 millimeters long) strongly resembles the type in markings; the pitlike depressions in the skin of the lower jaw are not evident; the tubercles on the back are dimmer. No. 350 (20 millimeters long) is very sparsely pigmented on the back. It was almost white when taken; the skin on the chin and the throat is slightly granulate; the pigment on the back is arranged in two very dim curving lines beginning behind eye; this marking is suggested in the type. No. 353 (19 millimeters long) is similar to No. 350; the sides are lighter, and the slightly curved markings on the back are present. The pigment is heavier between the shoulders and as far forward as the line between the eyes. The snout and the area below the eye are distinctly lighter; the skin of the throat and the chin is smooth. No. 348 (17 millimeters long) has brown spots about the dorsal tubercles and a deep brown line behind eye to insertion of arm; the snout is very light. Nos. 352 and 354 (each 15 millimeters long) have a hair line from between the eyes to above the anus. No.

355 is almost white above with a fine line from the tip of the snout to above the insertion of the arm.

The distinct spots on the two outer fingers are very characteristic. There is some variation in the folds about the tympanum; some of the specimens show these very dimly. In certain specimens the vomerine teeth begin at the hinder edge of the choanæ.

Remarks.—Save for the presence of very distinct groups of vomerine teeth I should regard this species as belonging unquestionably to the genus *Philautus;* as it is, I have referred it to that genus with some hesitancy. However, the presence or absence of vomerine teeth is scarcely a generic distinction since we find them present or absent in the very closely related genus *Polypedates.* The character of the digits places it with *Philautus* rather than with *Polypedates.*

The specimens were discovered concealed under and about the leaves of low-growing plants in southern Polillo. The type locality is on a trail running from the walled town of Polillo to the southeastern point of the island (known as Bislian) at a point where the trail crosses the low divide. These specimens were taken during an hour's collecting in this locality. Intensive collecting for nearly one month on the island failed to reveal the species elsewhere.

Philautus zamboangensis sp. nov.

Type.—No. 1059, E. H. Taylor collection; collected near Pasananka, Zamboanga, Mindanao, September 26, 1920, by E. H. Taylor.

Description of type.—Choanæ large, widely separated, partially concealed by overhanging jaw; no vomerine teeth; tongue rather short, forked behind; the openings of the vocal sacs elongate, nearly half the length of jaw; snout short, truncate; eye large, its diameter equal to or minutely less than its distance from end of snout; the distance between nostrils greater than their distance from eye; tympanum small, distinct, partially covered by the supratympanic fold, about one-third the diameter of eye; upper eyelid only minutely less than interorbital distance; interorbital area with a raised prominence followed by a circular depressed area; a broad, shallow depression covering snout; skin of body smooth above with no trace of granules; no tubercles on eyelids; skin on chin and throat smooth or with fine granulations; belly finely granulate; numerous much-enlarged granules about anus; arm very short, the fingers with well-

developed, rounded pads; no web, or only a very small one, between first and second fingers; second and third fingers one-third webbed, third and fourth nearly one-half webbed; subarticular tubercles strongly developed; several small tubercles on palm; a skin fold on outer side of fourth finger ending in a rounded carpal tubercle; two large tubercles at base of first finger; a broken glandular fold on outer side of forearm; first finger not extending as far as second; foot about two-thirds webbed, the web reaching to near base of disk on the outer side of second and third toes but failing to reach base of penultimate phalanx on fourth; subarticular tubercles well defined; a strong inner metatarsal tubercle on outer side of first toe near base; outer metatarsal tubercle very small; a fold on outer side of fifth toe not continued beyond tubercle; a slight skin fold on heel; hind limb brought forward the tibiotarsal articulation reaches tip of snout.

Color in life.—Above grayish white on head and body; a dark cinnamon brown bar between the eyes, and dark cinnamon dots scattered on back and limbs; throat cream; belly lemon; under thighs and in groin deep yellow; spots on posterior part of femur and skin fold on heel cream; lores lighter than snout; a sharply defined cream spot below eye which involves part of lid; a dark area on tympanum, following cream spot; a black area below anus and a blackish line from heel to sole of foot; undersurface of hand yellow, of foot light brown.

Measurements of Philautus zamboangensis sp. nov.

	mm.
Snout to vent	28
Width of head, at tympanum	10.5
Length of head, to angle of jaw	10.5
Eye to tip of snout	6
Diameter of eye	4.8
Interorbital distance	4
Tympanum	1.5
Forelimb	16.5
Longest finger, from wrist	9
Hind limb	51
Femur	16
Tibia	16
Longest toe	12

Remarks.—This species appears to be related to *Philautus bimaculatus* (Peters) and *P. montanus* Taylor. From the former it differs in having the openings of the vocal sacs elongate slits, nearly half the length of the jaw; in the absence of strong tubercles on the under jaw; in having a shorter arm; the distance

between the nostrils being greater than their distance from eye; the undersurface of foot having subarticular tubercles; and in the lesser extent of webbing on foot. The species agree in the shape of the head and the general conformation of the hand. *Philautus montanus* differs from *P. zamboangensis* in having the first and second fingers in opposition to the third and fourth, instead of the first in opposition to the other three.

The only specimen seen was discovered seated in an unfolding leaf of a low plant on the bank of Tumugao River, above the waterworks' intake near Pasananka, Zamboanga. Shortly after capture the specimen became a deep orange color.

Cornufer cornutus sp. nov.

Type.—No. 764, E. H. Taylor collection; collected at Balbalan, Kalinga, Mountain Province, Luzon, April 24, 1920, by E. H. Taylor.

Description of type.—Vomerine teeth in two small, more or less rounded series lying behind the inner edge of choanæ, widely separated from each other; choanæ small, not concealed by jaw; tongue nicked behind, with a distinct papilla on anterior part; snout rather pointed in front of nostrils; canthus rostralis distinct, the lores concave, then sloping obliquely to lip; snout somewhat constricted behind nostrils; nostril a little nearer tip of snout than eye; interorbital distance distinctly wider than upper eyelid, slightly less than distance between nostrils; upper eyelid with numerous, large, rounded tubercles and a well-developed, sharp-pointed dermal spine 1 millimeter long, which projects outward in life; eye small, equal to or slightly longer than its distance from nostril; tympanum small, about two-fifths of eye; a strong supratemporal fold from behind eye to insertion of arm slightly overhanging tympanum; a tubercular fold below eye immediately in front of tympanum and a fold crossing angle of jaws; a few scattered tubercles behind eye; skin generally smooth or finely shagreened, with dim indications of tubercles on back, limbs, and sides; skin on chin and throat smooth; posterior part of belly and underside of femur strongly granulate; fingers with strongly dilated disks, first finger very small, the tip scarcely dilated; fourth finger longer than second; subarticular tubercles large, distinct; small tubercles on palm, and large carpal tubercles; tips of toes dilated but much less so than fingers; a very strong outer metatarsal tubercle, and a dim elongate inner one; hind limb being brought forward the tibiotarsal articulation reaches eye or slightly beyond.

Color in life.—Blackish brown above with two putty-colored lines on side of back; small, scattered, greenish spots on back; spots on tympanum, loreal region, and top of head putty-colored; groin yellow; sides of body slightly yellow; upper part of femur yellowish green; throat and belly whitish; femur and tibia greenish yellow below. When preserved in alcohol the greenish spots appear black. The spots on the tympanum, below the canthus rostralis, and on the upper lip are strongly pronounced.

Measurements of Cornufer cornutus sp. nov.

	mm.
Snout to vent	31.6
Length of head, to behind tympanum	11
Width of head, at tympanum	12
Depth of head	5
Forelimb	20
Longest finger, to wrist	10.2
Hind limb	49
Longest toe, to metatarsal tubercle	15
Diameter of eye	3.8
Eye to tip of snout	6.2

Remarks.—The type was collected from a bush growing in the small stream which furnishes drinking water to the town of Balbalan. It was found seated on a broad leaf directly above the water. Only a single specimen of this new species of *Cornufer* was found in ten days' collecting at Balbalan. This species, more than any other of the numerous species of the genus, is worthy of the name "horn-bearer." The peculiar spine above the eye easily differentiates it from other known species of *Cornufer* in the Philippines.

Kaloula rigida sp. nov.

Type.—No. 7681, E. H. Taylor collection; collected at Balbalan, Kalinga, Mountain Province, Luzon, April 26, 1920, by E. H. Taylor.

Description of type.—(Adult female.) Choanæ large, partially concealed by overhanging jaw, separated from one another by a distance equal to diameter of choanæ; two strong, transverse, palatal ridges immediately behind choanæ, very narrowly separated medially; in front of œsophagus a wide, dermal, transverse, palatal ridge, which is preceded by a second arched ridge; tongue broadly oval, entire; snout short, truncate; rounded on edge; loreal region nearly perpendicular; diameter of eye longer than its distance from end of snout; nostrils as far forward as tip of snout, which slopes backward and down-

ward to mouth; tympanum small, dimly outlined, covered with skin; a distinct fold from behind eye to insertion of arm; a dim fold in front of tympanum and another short fold behind angle of jaw; skin above uniformly corrugated save on tip of snout and lores; belly more or less smooth; a dim suggestion of granulation on throat and chin and on inferior and posterior aspects of femur; tips of digits on hand slightly swollen, no wider than digits; subarticular tubercles moderately developed, large, rather flattened; carpal tubercles not prominent; toes without disks; subarticular tubercles on foot large, flattened, not strongly differentiated; a round, outer metatarsal tubercle and an elongate, blunt-edged, inner tubercle; a small but distinct web between toes; leg brought forward the tibiotarsal articulation does not reach beyond insertion of arm; femur involved in body skin for more than half its length; males with internal vocal sacs.

Color in life.—Above deep lavender to purple, slightly iridescent; lighter lavender to brownish in groins and above limbs; dim traces of spots on limbs and a darker triangular area about anus; belly dirty light brown, mottled and reticulated with lighter color; chin and throat dark with fine reticulations of dirty white.

Measurements of the type of Kaloula rigida sp. nov.

	mm.
Length, snout to vent	47
Length of head, to behind tympanum	11
Width of head posterior to edge of eye	15
Distance between posterior corners of eyes	11
Depth of head posterior to eye	7.5
Length of forelimb	30
Longest finger	14
Length of hind limb	60
Length of longest toe, to outer metatarsal tubercle	19

Variation.—Twenty-two specimens of this species were taken breeding in rain pools in the town of Balbalan, from April 28 to April 30, 1920. Most of the specimens are identical in most details with the type; a few vary in color and markings and in the condition of the skin. The females are distended with eggs, and when alive they were almost triangular in shape. Most of the specimens are colored like the type. One female (No. 838A) is light lavender-brown above with purplish black markings on the back, arranged roughly in the shape of a human being with limbs outstreched; there are two well-defined dark spots above the anus, and the limbs are distinctly spotted; the lores and the

side of the head and body are of a uniform purplish color. The anterior aspect of the femur is also dark.

Several specimens, representing a variation of this species, were taken from under stones in the garden of the Hotel Pines, Baguio, on April 12, 1920. They differ markedly from the type in having the skin very smooth and shiny. The marking on the back is similar to that of specimen 838A but with numerous, rounded, black spots scattered over the back and the sides. When first disturbed the specimens lay flat, stretched their legs out behind, and remained rigid. They were picked up in this condition and remained motionless for a considerable time. One large female, with her body much distended with eggs, has the femur involved in the body skin more than two-thirds of its length.

One specimen (No. 7680, taken at Bontoc, April 20, 1920) was bright brown-red, the skin as smooth and shiny as patent leather. There are a few rounded black spots on the back. The specimen was found burrowed about 10 centimeters deep in loose earth.

This species is related to *Kaloula picta* Duméril and Bibron, but differs in the shape of the head and the body, the size and prominence of the metatarsal tubercles, and the shorter inner toe. Numerous other differences are evident on a comparison of specimens.

Kaloula kalingensis sp. nov.

Type.—No. 824, E. H. Taylor collection; collected at Balbalan, Kalinga, Mountain Province, Luzon, April 28, 1920, by E. H. Taylor.

Description of type.—(Adult female, containing eggs.) Palatal ridges behind choanæ not strongly developed, not meeting medially; choanæ small, not concealed by overhanging jaw; two denticulated ridges across palate in front of œsophagus, the posterior straight, the anterior distinctly arched; tongue oblong, entire, free behind; snout short, truncate, angular in outline from above, extending very slightly beyond lower jaw; nostrils lateral, not or scarcely visible from above, profile at the extremity of snout; distance of nostril from eye greater than its distance to edge of mouth; canthus rostralis rounded; loreal region perpendicular; eye large, length of orbit greater than length of snout; lower eyelid with an opaque, cream-colored area; interorbital distance one and one-half times the width of upper eyelid; tympanum distinct, about three-fifths of eye; a dim skin fold begins behind eye and becomes heavier

behind tympanum; it continues above arm, where it becomes thickened and glandular; a strong fold behind angle of mouth below and behind tympanum, continuing across throat; a deep groove, beginning behind tympanum and continuing to behind insertion of arm, separates the folds; skin above with flattened pustular tubercles prominent on snout, lores, sides, back, and limbs; skin on chin with small granulations; skin on chest smooth, on belly and femur strongly granular; fingers strongly dilated at tips into angular pads more than twice the width of the fingers; anterior edges of pads straight or slightly concave, sides nearly parallel; first finger reaches base of pad on second; second and fourth toes equal, reaching base of pad on third; subarticular tubercles strong, two on third and fourth toes; three distinct carpal tubercles; toes with small, slightly truncate or rounded pads, not or scarcely wider than toes; a strong, oval, inner metatarsal tubercle and a smaller, rounded outer one; subarticular tubercles strongly developed; a single tubercle under first and second toes; two under each of the other three; toes with no or only a very slight rudiment of web; the leg brought forward the tibiotarsal articulation fails to reach tympanum by a distance equal to diameter of tympanum.

Color in life.—Bluish black above with deep red markings on neck, sides, and limbs; minute cream markings on each side of anus; belly and underside of limbs mottled with creamy white; tubercles under digits white; throat and chin blue-black.

Measurements of the type and the cotype of Kaloula kalingensis sp. nov.

	No. 824 ♀, type.	No. 856 ♂, cotype.
	mm.	*mm.*
Snout to vent	36.5	34.0
Length of head	9.5	9.5
Width of head	13.5	11.0
Diameter of eye	4.8	4.4
Length of snout	4.0	3.9
Width of body, greatest	18.5	16.0
Longest finger	11.5	10.2
Forelimb	23.0	22.0
Hind limb	46.0	44.0
Tibia	15.0	13.0
Longest toe	15.5	13.8

Variation.—A second specimen agrees with the type in practically all details. It is slightly smaller, as shown in the table of measurements. The tympanum is less distinct and the de-

velopment of the post-temporal folds is not so marked, nor is the groove so pronounced. The specimen is a male and has a subgular vocal sac.

Remarks.—The two specimens listed above were taken in rotting logs. They were located by their loud raucous call, which differs distinctly from the call of *Kaloula rigida* sp. nov., found breeding in the same immediate locality. The two species are known to the Kalinga people by the name *gá-ko*. This species seems to be related to *Kaloula baleata* (Müller). From the description and drawing of that species given by Boulenger it differs particularly in the shape of the fingers pads, the length of the third finger, the presence of tubercles on the palm, the number of subarticular tubercles under third finger and fourth toe, and in the distinctness and size of the tympanum. I have remarked [3] that Meyer's specimens of *Kaloula baleata* are the only ones so far reported from the Philippines; there is a chance that an exchange of labels occurred, since Meyer collected the same species in Celebes. The Philippine specimens purport to come from Laguna de Bay.

Kaloula negrosensis sp. nov.

Type.—No. 538, E. H. Taylor collection; collected at Hinigaran, Negros, in April, 1915, by E. H. Taylor.

Description.—Palatine bones forming straight ridges behind choanæ, the ridges widened medially and very narrowly separated; choanæ very large, separated from each other by a distance equal to less than twice the diameter of one, the outer edges somewhat hidden by the overhanging jaw; a strongly defined denticulate dermal ridge across palate in front of œsophagus; a second ridge only dimly defined; snout short, truncate, nostrils near anterior end; canthus rostralis rounded, loreal region slightly concave; eye as long as its distance from end of snout; a strong fold begins behind eye and runs in a straight diagonal line across the dimly defined tympanum to in front of insertion of arm; a fold below tympanum behind angle of mouth, separated from tympanic fold by a distinct groove; skin above on body with distinct tubercles, practically absent laterally; skin on throat, breast, and greater part of belly smooth, somewhat granular on posterior part of belly, on femur, and about anus. Fingers dilated into distinct, truncate disks, nearly a

[3] Amphibians and Turtles of the Philippine Islands, Bureau of Science publication 15 (1921) 194.

half wider than digits; first finger short, not reaching pad of second; fourth finger longer than second, reaching the last subarticular tubercle on third; subarticular tubercles large, not clearly differentiated; three carpal tubercles very distinct; tips of toes not or but slightly widened; a strong inner metatarsal tubercle nearly the length of first toe, and a small outer one; subarticular tubercles well defined, two on each of the outer three toes; toes nearly one-third webbed. Tibiotarsal articulation reaches tympanum when adpressed.

Color in life.—Brownish with very indistinct darker markings above; rather brownish below.

Measurements of the type and the cotype of Kaloula negrosensis sp. nov.

	No. 538, type.	No. 538A, cotype.
	mm.	*mm.*
Snout to vent	30.0	29.5
Length of head	8.5	8.5
Width of head	11.0	10.0
Diameter of eye	3.6	3.5
Length of snout	3.5	3.5
Width of body, greatest	17.0	13.0
Forelimb	20.0	19.0
Longest finger	8.2	8.0
Hind limb	39.5	39.5
Tibia	13.0	12.6
Longest toe, to metatarsal tubercle	12.5	11.5

Variation.—The cotype, also from Negros, shows slight variation; the body and head are slenderer. The fourth toe on the right foot is abnormal, being no longer than the third but much broader and with a wider pad at the tip; the markings on this specimen are distinct. There is a large brown spot on the anterior part of the back with two narrow branches to each eye; two short, truncate, lateral branches above arms and two short posterior branches. Two equal-sized spots are separated from the ends of the posterior branches of the dorsal marking and there is another pair of spots in front of the anus. A distinct bar crosses femur, tibia, and foot, apparently continuous when the leg is folded. There is a dark brown area in the loreal region and another brown area laterally, beginning behind the tympanic fold. The belly is uniform light olive brown.

Remarks.—The specimens were taken moving about at night in the street. Only these two specimens were found in my two

years' residence in Negros. The specimens were mentioned in my former publications on Philippine Amphibia.[4]

A further comparative study of the material has convinced me that it represents a species distinct from *K. conjuncta*. It differs from *Kaloula kalingensis* in the different length of the toes, the much narrower pads and their shape, in markings and coloration, and in the amount of webbing. The foot is distinctly broader in *K. negrosensis*.

Bufo mcgregori sp. nov.

Type.—No. 1468A, E. H. Taylor collection; collected near Pasananka, Zamboanga, September 30, 1920, by E. H. Taylor.

Description of type.—(Adult male.) Choanæ small, nearly hidden under the overhanging jaw; tongue elongate, oval, free behind; openings of vocal sacs elongate slits; snout bluntly conical when viewed from above, extending beyond lower jaw and sloping obliquely downward; a distinct keel from tip of snout to mouth; canthus rostralis distinct, loreal region nearly perpendicular, with a depression behind nostril; median area on snout with a broad shallow groove; two slight, rounded ridges on the interorbital area; eye large, prominent, much longer than its distance from end of snout; no evidence of tympanum; a strong constriction a short distance behind eye, separating head from body, represented dorsally by two distinct depressions in front of shoulders; depressions surrounded by glandular skin; snout, eyelid, temporal area, and back very strongly tubercular; upper lip rather glandular; sides and limbs strongly tubercular; belly and throat very strongly granular; fingers long, well developed, the first shorter than second; finger tips swollen, not or very slightly wider than digit; subarticular tubercles dim; two large carpal tubercles; tips of toes swollen into small pads, not widened; the web extends to pads on all but fourth toe, where it reaches to base of last joint; subarticular tubercles dim; three metatarsal tubercles, a prominent, rounded, outer tubercle, and two flattened,. inner tubercles subequal in size; the membrane on outer side of first toe continues on inner side of leg; leg brought forward tibiotarsal articulation reaches to anterior corner of eye.

Color in life.—Above deep olive, variegated with lighter and darker areas; throat blackish; belly muddy, underside of femur dirty white; scattered, minute, cream-colored spots on belly.

[4] Philip. Journ. Sci. 16 (1920) 327; Amphibians and Turtles of the Philippine Islands, Bureau of Science publication 15 (1921) 194.

Measurements of Bufo mcgregori sp. nov.

	mm.
Snout to vent	37
Width of head	12
Length of head	13
Length of snout	4.5
Length of eye	5.2
Interorbital area	4.3
Upper eyelid	3.5
Forelimb	26
Longest finger	11.3
Hind limb	57
Longest toe, to metatarsal tubercle	15
Femur	18
Tibia	19

Variation.—Practically all the specimens agree in detail with the characters given in the description of the type. The sharp ridge on the end of the snout, the slight ridges between the eyes, the constriction of the neck behind the temporal region, the rounded depression behind, the absence of any indication of tympanum, the groove on the snout, the presence of strong tubercles over the dorsal surface, the presence of three metatarsal tubercles, and the extent of the webbing on the fourth toe are characters strongly evident in every specimen. The largest specimen is 40 millimeters long. The belly is usually pinkish flesh to dirty white, marbled with darker. Certain of the specimens have indications of dark markings on the back and the limbs with light and dark bars.

Remarks.—This species is related to *Bufo muelleri* Boulenger, from which it differs in the constriction of the neck, with rounded depressions in the post-temporal region (characters apparently absent in *B. muelleri*); in having the entire upper surface of the body very strongly tubercular (smooth in *B. muelleri*); three instead of two metatarsal tubercles; and a lesser extent of webbing between the toes.

Specimens were found in Tumugao River, Zamboanga, Mindanao, about 1 kilometer above the waterworks' intake. They were discovered clinging to spray-moistened rocks, in midstream. When disturbed they dived into the swift-flowing water and took refuge under stones at the bottom. Sixteen specimens were obtained. Found only in this locality. The species is named for Richard C. McGregor, ornithologist of the Bureau of Science.

Megalophrys hasselti (Tschudi).

Leptobrachium hasselti TSCHUDI, Class. Batr. (1838) 81.

No. 1597A, E. H. Taylor collection; collected at Abung-abung, Basilan, October 21, 1920, by E. H. Taylor.

Description.—Vomerine teeth wanting; choanæ large, not concealed by jaw, separated by a distance equal to distance of nostril from eye; palatal ridges behind choanæ low; tongue with a distinct nick; head large, about as long as broad; snout rounded, not projecting beyond lower jaw; canthus rostralis distinct, not or but slightly rounding; nostril pierced halfway between tip of snout and eye; loreal region very slightly concave, strongly oblique; interorbital space broader than upper eyelid; eyes large, prominent, extending beyond edge of jaw in profile; tympanum feebly distinct, separated from eye by a distance equal to one-half its diameter, slightly more than half the diameter of eye; a strong fold above tympanum to behind angle of jaw above insertion of arm; no trace of dorsolateral folds; skin on head and above eyes distinctly granulate; fingers obtuse, not swollen at tips; first finger equal to or slightly longer than second; third twice as long as second; subarticular tubercles irregularly elongate, sometimes coalescing into elongate ridges; two strongly defined carpal tubercles, the inner larger than the outer; toes obtuse at tips, not enlarged; subarticular tubercles irregular or forming ridges, usually distinct under longest toe; a very slight web, scarcely discernible, at base of toes; inner metatarsal tubercle moderately prominent, oval; no outer tubercle; tibiotarsal articulation reaches to near angle of jaw; foot slightly longer than head; skin on sides of body granular, with series of larger tubercles; chin and throat granular; belly smooth; underside of femur slightly granular; two strongly developed, large, flat tubercles, or glands, on breast near insertion of arm.

Color in life.—Dark purple above with no trace of spots; the granules above slightly lighter; sides of belly with each granule cream yellow, the larger tubercles surrounded by dim black rings; underside of throat dull purplish, mottled with small dots of cream; middle of belly dirty yellow, unspotted; tubercles at base of arm yellow.

Variation.—A second specimen obtained in the same locality (No. 1597) agrees in practically all details save that distinct, islandlike markings of black or dark purple are evident on the back, as are spots on the lips and snout.

Measurements of Megalophrys hasselti (Tschudi).

	No. 1597A.	No. 1597.
	mm.	*mm.*
Snout to vent	55.0	50.5
Length of head, to jaw angle	25.0	23.0
Width of head	23.0	22.5
Length of snout	10.5	9.5
Diameter of eye	8.0	7.5
Interorbital width	5.5	7.0
Diameter of tympanum	4.2	4.7
Eye to tympanum	3.5	3.0
Forelimb	33.5	34.2
Hand	12.5	12.0
Hind limb, from vent	58.0	60.0
Femur	21.0	20.5
Tibia	19.0	18.5
Tibia, to tip of longest toe	26.0	25.0

Remarks.—These specimens agree fairly well with the published descriptions of *Megalophrys hasselti* (Tschudi). The two specimens are males; both have internal vocal sacs, the openings of which are far back and concealed by skin fold.

The call of the species sounds like nothing so much as the harsh raucous squawk of a chicken. The calls were heard while collecting in dense forest at night. Efforts to find them at night were fruitless. The spot was visited by daylight and after sweeping leaves from over a considerable area the two specimens were found.

This is the first record of this species for any Philippine locality save Palawan. I suspect that it also occurs in Mindanao.

Gekko porosus sp. nov.

Type.—No.—, E. H. Taylor collection; collected on Itbayat Island, Batan Islands (between Luzon and Formosa), November 21, 1921, by G. F. Lopez.

Description of species.—Snout moderately pointed; rostral, bent back over snout, borders nostril; posterior part depressed medially, but raised in front of nostrils; two short sutures enter rostral posteriorly in the depressed area; two large internasals border rostral, separated by a single small scale; two distinctly enlarged postnasal scales border nostril; a narrow depression between nostrils, continuing backward on forehead where it widens; two or three rows of somewhat enlarged scales beginning at internasals and following along the elevated borders of the depression, a group of somewhat enlarged scales in front of eyes, not joined with the other series;

granules on supraocular regions larger than those on interorbital or occipital areas; twelve upper labials, last one or two very small; ten lower labials; mental large, distinctly triangular, bordered behind by two large, elongate chin shields at least twice as long as wide; chin shields distinctly pointed in front and truncate behind, in contact with anterior lower labial for more than half their length and forming a mutual suture equal to nearly four-fifths their length; an enlarged scale separates the chin shields from second labial; two or three other enlarged scales bordering chin shields; granules on chin and throat uniform in size; body above covered by minute granules intermixed with small, rounded tubercles arranged in sixteen irregular rows; only a faint suggestion of a skin fold limits the abdominal region; forty-two rows of cycloid imbricating scales on abdomen; tubercles on upper surface of legs; two rows of tubercles continue on tail for about one-third of its length; tail with annulations distinctly marked on anterior part by straight, regular, transverse rows of scales; twelve or more irregular transverse rows to each annulation; tail below with widened scales of practically uniform length and width; scales in the swollen area behind anus distinctly enlarged; occipital region with an irregularly edged, depressed area; a slight prominence above auricular opening; digits widened with undivided transverse lamellæ below, fifteen under fourth toe of each foot; adpressed hind leg reaches beyond elbow of adpressed foreleg; scales preceding vent slightly enlarged, growing somewhat smaller immediately in front of pore scales; a very long series of preanal and femoral pore scales meeting medially in a broad angle; femoral pore scales continue to near end of femur, each scale with a distinct circular depression; eighty scales, forty on each side; ear opening irregularly oval, its diameter about one-third of eye.

Measurements of the type of Gekko porosus sp. nov.

	mm.
Total length	111
Snout to vent	50
Tail	61
Snout to foreleg	22
Snout to eye	7
Axilla to groin	21
Foreleg	17
Hind leg	22
Diameter of eye	5
Length of head	16.5
Width of head	10

Color (*in alcohol, freshly preserved*).—Above gray, with darker transverse blotches, somewhat darker on the sides of the neck; no stripes or markings on the head; tail distinctly barred with dirty white on the latter third, dimmer on the median third, and very indistinct or wanting on the basal third; limbs mottled with darker gray, apparently without bands; below dirty flesh white; lamellæ under toes dark; no labial markings.

Remarks.—The specimen was obtained from Batan Islands by Gregorio Lopez, who accompanied a relief expedition sent to the Batanes by the Government of the Philippine Islands. He stated that the specimen was caught in a house by a resident of Itbayat Island.

The species is related in a general way to *Gekko japonicus* Duméril and Bibron and to *G. swinhonis* Günther. It differs from *G. japonicus* in the larger number of tubercles on the back, the scalation of the forehead, the very much larger number of pore scales (which very probably represent the number of preanal and femoral pores in the males), and in the markings; *G. swinhonis* differs from the species here described in having no tubercles on the back and fewer preanal and femoral pore scales. From *G. smaragdinus,* a new species described in this paper, *G. porosus* differs in color and markings and in the shape of the body, as well as in scalation and the number and arrangement of the pore scales.

Gekko smaragdinus sp. nov.

Type.—No. 260, E. H. Taylor collection; collected on Polillo Island, July 12, 1920, by E. H. Taylor.

Description of type.—(Adult male.) Rostral large, bent backward over snout, depressed medially but raised in front of nostril, bordering nostril; a slight suture enters rostral medially above; nostril surrounded by rostral, first labial, a supranasal, and two postnasals; an enlarged scale in contact with postnasals but not entering nostril; scales on snout equal, larger than those on occiput; upper labials larger anteriorly, becoming very small near angle of mouth, seventeen on right side, eighteen on left; the row of scales immediately above upper labials distinctly enlarged; lower labials fourteen and fifteen; mental small, rectangular; the rows of scales bordering lower labials somewhat enlarged, the two largest separated from mental by three scale rows; behind these, some distance on each side, is a row of four larger scales separated from labials by one scale row; body above covered with minute, equal-sized

Measurements and scale counts of Gekko smaragdinus sp. nov.

No.	Sex.	Length.	Snout to vent.	Tail.	Axilla to groin.	Foreleg.	Hind leg.	Head width.	Head length.	Labials.		Scales between internasals.	Preanal pores or scales.	Snout to eye.	Eye to ear.	Wide lamellæ under long toe.
										Upper.	Lower.					
		mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*					*mm.*	*mm.*	
260	♂	121	59	62	28	16.5	24	11.2	16	15–18	14	3	20–20	6	5.1	19–18
266	♂	124	61.5	62.5	30	17.5	25	10.5	17	14–16	13–15	4	20–20	6	5	21–21
257	♂	114	55.5	58.5	27	17	22.5	9	14.5	18–18	15–15	3	18–19	5.7	4.8	20–21
256	♂	114	55.5	58.5	28.5	17.5	22.1	10	15.5	16–20	15–16	4	23–22	5.8	4.9	20–22
258	♂	119	62	57	31.5	17.5	25	11	17	16–17	15–15	3	20–19	6	5	21–22
255	♀	124.5	58.5	66	32	17	23	10	18	15–16	14–14	3	20–21	6	4.8	19–19
265	♂	120	58	62	30	18	24	9	15	15–16	13–14	4	20–21	6	4.5	19–20
261	♀	120	62	58	33	18	25	10	14.8	16–17	15–15	3	19–20	6.1	4.8	18–19
267B	♂	104	58.5	45.5	30.5	20	24	9.8	15	16–19	16–16	4	21–21	6	5	18–18
265A	♂	118	61	57	30	20.5	25.5	10.5	16	15–17	15–16	3	19–20	6.1	5	19–19
265B	♀	126	63	63	32	17	24	10	17	15–16	14–15	4	19–20	6.2	5	18–18
259	♀	90	61	29	32.2	16.5	23.5	10	15	16–18	14–15	3	21–21	6	4.9	21–21
267	♀	115	58.5	56.5	28	17	22.5	9	14	16–18	15–15	4	23–22	5.5	4.5	19–19
267A	♂	112	55	57	26	15.1	22	9	14	15–16	13–14	3	19–20	6	4.2	18–18
262A	♂	110	56	54	28	17	22	9	14	17–17	15–16	4	21–21	6	4.9	19–18
262	♀	117	58	59	30.1	18	22	10	16	18–19	14–15	4	21–22	6	4.5	19–18
263A	?	----------	----------	----------	----------	18	----------	10.2	17	18–19	13–15	3	----------	7	4.5	----------
264	♂	75	55	20	28	18.1	21.5	10	14.5	16–17	13–13	3	19–20	5.6	4.7	17–18
263	♀	----------	54	----------	29	15.5	21	8	14	17–17	13–14	3	19–20	5.2	3.8	18–18
262B	♂	84	55	29	26	17	22	8.2	14	16–18	14–15	3	19–22	6	4.4	18–19
264A	♀	80	50	30	24	17.5	21	8.8	13.5	15–16	13–15	4	22–22	5.8	4	18–18

granules, with no evidence of tubercles; scales on belly larger, imbricate; no evidence of a lateral skin fold; scales on posterior part of chin and throat very small, equal; tail not annulate; preanal and femoral pores continuous, forming an arch medially, seventeen pores on each side; scales anterior and posterior to pore scales only slightly larger than other belly scales; scales directly in front of anus only slightly enlarged; digits flattened through entire length, with a single row of lamellæ below, seventeen under longest digit on foreleg, twenty-one under longest toe; the lamellæ on base of digits broken into from two to four scalelike elements; body extremely elongate and narrow, of equal width throughout entire length; tail tapering gradually, only slightly flattened.

Color in life.—Body above clear yellow-green to leaf green, more green on back than on sides and on limbs; side of head yellowish; numerous, rounded, black spots on head and shoulders arranged more or less regularly; a series of dim, uneven, cream spots begins behind the eye and continues halfway along the body on each side; iris of eye golden yellow; distal two-thirds of tail reddish brown, to salmon below, with series of cream yellow spots bordered by black almost circling the tail; belly whitish yellow; underside of limbs very light yellow-green to greenish yellow.

Measurements of the type of Gekko smaragdinus sp. nov.

	mm.
Total length	133
Snout to vent	62
Tail	71
Snout to foreleg	24
Axilla to groin	34
Foreleg	19
Hind leg	25
Length of head, to auricular opening	14
Width of head	10
Greatest body width	7
Snout to eye	6.7
Eye to auricular opening	4.8
Diameter of orbit	4
Diameter of auricular opening	1.2

Variation.—There are twenty-one cotypes in the collection taken at practically the same time as the type. The variations in measurements are due to the different ages of the specimens. There are fourteen to nineteen upper labials and thirteen to sixteen lower labials. This large difference is due to the degree

of differentiation of the small scales that border the posterior part of the mouth, after the mouth curves upward. There are three or four small scales bordering the rostral behind. There are eighteen to twenty-two lamellæ under the longest toe, the variation being chiefly in the basal count. The arrangement of the preanal and the femoral pores varies in some individuals. In a few of the specimens the line curves distinctly upward at the beginning of the femoral pores. In others no such curve is evident. There are eighteen to twenty-three pores on each side.

The coloration was practically uniform in the specimens when they were first taken. Some of the specimens have more black spots on the head and the anterior part of the body than others.

Remarks.—The species was discovered on a species of large *Caladium*. The specimen took refuge under water which was held in the petiole of a huge leaf. All other specimens were taken from *Pandanus* trees which were growing along small streams. The spiny-leaved trees were cut and allowed to fall in the water. The specimens were finally driven from their hiding places in the leaf axils and forced to swim to land. These spiny *Pandanus* trees were splendid collecting places and harbored, besides the described species, several species of frogs and lizards.

This species belongs to the section of the genus *Gekko* which includes *G. swinhonis* and is characterized by the absence of tubercles on the back. The number and arrangement of the preanal pores and the very distinctive markings easily separate the species. Many differences are evident from a comparison of descriptions. It would appear that the species is very closely associated with the *Pandanus* trees. This association may account for the fact that it has not been collected before.

Ptychozoon intermedia Taylor.

Ptychozoon intermedia TAYLOR, Philip. Journ. Sci. § D 10 (1915) 95; Lizards of the Philippine Islands (1922) 101.

A female specimen of *Ptychozoon intermedia* Taylor (No. 1075), taken near Zamboanga, agrees with the type specimen taken in eastern Mindanao, save that there are no rounded tubercles on the back. Each annulation on the tail is marked posteriorly with enlarged spinous tubercles, much as is the type; the granules on the neck and the back are smaller. The scales under the tail are divided into two rows of enlarged scutes, while in the type occasional scales are not divided, and others are divided into more than two parts.

Measurements of Ptychozoon intermedia Taylor.

	mm.
Total length	176
Snout to vent	88.5
Length of head	24.5
Depth of head	10
Width of head	19
Axilla to groin	45
Foreleg	28
Hind leg	39
Width of lateral flap	8.5
Length of femur	15
Body width	21
Snout to orbit	11
Length of longest finger	9.5
Length of longest toe	11.5

Remarks.—It will be seen that the measurements of the second specimen agree very well with those of the type. This specimen is dark black-brown over the greater part of the body; the deep brown, wavy lines on the back are scarcely distinguishable.

On the tree from which the adult was taken, two eggs were found under bark attached to the tree. The eggs were joined together. The greatest diameter of either egg was 15.5. One egg was opened to verify beyond doubt its identity. The embryo measured 28 millimeters from snout to vent; tail, 26; the narrow flap on the tip of the tail is present as in the adult. The young is very strongly marked in a pattern similar to that in the type.

In southern Basilan certain freshly laid eggs of what appears to be this species were taken in October, 1920, but no adult was seen. In 1917 I found an egg on Buluan, a small island south of Basilan, containing a double-headed embryo of what was undoubtedly this species. I lost the specimen while swimming from shore to my launch across the coral reef.

Draco mindanensis Stejneger.

Draco mindanensis STEJNEGER, Proc. U. S. Nat. Mus. **33** (1908) 677; TAYLOR, Lizards of the Philippine Islands (1922) 128.

The type and cotype of this species were collected by Dr. E. A. Mearns, at the base of Mount Malindang, western Mindanao. Both specimens were males. The two specimens here recorded are from the tip of Zamboanga Peninsula, near Zamboanga, nearly 200 kilometers distant from the type locality. A male and a female were taken, both apparently belonging to Stejneger's species. The sexes vary greatly in color and markings.

Description of adult female.—Agrees with Stejneger's description save in the following points: Rostral two and one-half to three times as long as broad, bordered by eight scales; nostril vertical in a raised, truncate, conelike scale, separated from

rostral by two scale rows; a median series of keeled scales with indistinct posterior diverging branches represented by two rows of keeled scales in each branch; occipital region with three differentiated scales, bordered by irregularly shaped, more or less keeled scales; a few large scales in a longitudinal row posterior to orbit; tympanum entirely hidden by small scales; thirteen upper labials (eleven on left side); no trace of nuchal crest; no enlarged or differentiated scales on neck; mental large, roughly triangular, not as long as rostral, but much wider; twelve lower labials; all scales on chin distinctly keeled, those along labials largest; back covered with irregular-sized, keeled scales; a few dorsolateral groups of enlarged scales; gular appendage distinctly developed, the anterior outline curving, the tip bluntly curved; near tip is a small spur about 1 millimeter long, emerging about 1 millimeter from tip; lateral nuchal membranes strongly developed. Otherwise this specimen agrees with the type in scalation.

Color in life.—Delicate yellow-green above; large paper white spots on back arranged in transverse lines; chin and underside of head pale greenish yellow; tip of gular appendage cream yellow; chin with cream dots; wings, above, blackish with numerous narrow lines and small dots; below, uniform dusky, without spots.

Adult male.—This male specimen agrees more closely with the type than does the female just described. There are fourteen and fifteen upper labials; there is a small nuchal crest. The gular appendage is longer than in the type.

Color in life.—Body yellow-olive above, mottled with areas of darker and lighter color, spots on back grayish white, in transverse rows. Wings, above, brown-red to brick red with narrow lines of minute cream dots; below, immaculate brown-red, growing purplish toward the outer, upper part; belly and underpart of limbs flesh color; gular appendage vivid orange yellow.

Remarks.—The development of the gular appendage in the female is greater than that in any other *Draco* known in the Philippines. The small spur on the tip appears to be a normal development. The two specimens were shot from trees in heavy forest, in low mountains, at an elevation of approximately 300 meters. No other specimen was seen.

Measurements of Draco mindanensis Stejneger.

	No. 1129, ♀.	No. 1130, ♂.
	mm.	*mm.*
Total length	265	205
Snout to vent	87	90
Tail	178	[a] 115
Width of head	14	12
Length of head	19	19
Foreleg	42	42
Hind leg	51	53
Gular appendage	9	23
Snout to eye	7.5	8

[a] Tip missing.

Sphenomorphus bakeri sp. nov.

Type.—No.—, E. H. Taylor collection; collected at Haight's place, Pauai, Benguet, Mountain Province, Luzon, April, 1921, by Charles Fuller Baker.

Description of type.—Rostral large, bent back over snout, forming a curved suture with frontonasal, broadened at base; frontonasal large, barely in contact with anterior loreal, rounded posteriorly, minutely in contact with frontal; prefrontals somewhat triangular, smaller than frontonasal, separated narrowly; frontal large, four-sided, the posterior tip slightly rounded, touching two supraoculars and first superciliary; frontoparietal large, single, broader than long, touching frontal; interparietal large, well developed; parietals about one and one-half times as long as broad, forming a suture behind interparietal; no nuchals; nostrils in center of a moderate-sized nasal scale; nasal in contact with one labial; two loreals, not superimposed, anterior higher and narrower than posterior, its lower tip inserted somewhat between the first two labials; two preoculars, and two small anterior suboculars; eyelid scaled, opaque; six or seven superciliaries; four large supraoculars, last bordered by two smaller scales, separating it from parietal; parietals bordered by three temporals; anterior much the largest; six upper labials, fifth largest, fourth longest; tympanum scaled over and indicated by a depression (unnoticeable when freshly preserved); mental large; five lower labials; one azygous postmental, followed by three pairs of chin shields, only first pair in contact; twenty-eight scale rows around body; two enlarged preanal scales; ten or eleven lamellæ under longest toe.

Color (*in alcohol, freshly preserved*).—Above brown, minutely powdered with darker brown, more pronounced medially, forming an indistinct dorsal line; side of head, neck, and anterior part of body bluish black but the color not solid; sides of tail scarcely darker than above; chin and throat darker, mental, postmental, and chin shields each with a large light spot; belly and underside of tail dirty white; limbs light brown with darker brown areas, and with lighter spots on posterior and anterior aspect of limbs and foot.

Measurements of Sphenomorphus bakeri sp. nov.

	mm.
Total length	38.5
Snout to vent	24
Snout to foreleg	7.5
Axilla to groin	11.5
Tail (tip regenerated)	14.5
Foreleg	6.5
Hind leg	7.5

Remarks.—This small skink was collected by Charles Fuller Baker on the mountain trail at Pauai, or Haight's place, 58 kilometers north of Baguio. The elevation here is about 2,500 meters. This is the highest elevation recorded in the Philippines for any reptile or batrachian. The species must be rare, as my two days' intensive collecting in this locality during April, 1920, failed to reveal it. This appears to be a diminutive species, similar in size to *Sphenomorphus steerei*, which it resembles in a general way. It may be differentiated from known species of *Sphenomorphus* by the scalation of the tympanum. When freshly preserved, no depression was noted where the tympanum is normally found, but after being removed a short time from the alcohol a depression became evident.

I name the species for its discoverer, Charles Fuller Baker, dean of the College of Agriculture, University of the Philippines, in recognition of his valuable contributions to the entomological knowledge of the Philippines.

Siaphos herrei sp. nov.

Type.—No. 208, E. H. Taylor collection; collected on Polillo Island, July, 1920, by E. H. Taylor.

Description of type.—Rostral large, bending backward over snout, the area visible from above equal to more than half the width of internasal; latter large, broader than long, narrowly in contact with frontal; prefrontals large, narrowly separated medially, forming sutures laterally with two frenals; frontal more than one and a half times as long as broad, diamond-

shaped, with a rounding point behind touching two anterior suproaculars, its width slightly less than that of supraocular region; frontoparietals large, forming a mutual suture twice as long as suture with parietals; interparietal broadly triangular, longer than broad; parietals not nearly twice as long as wide, forming a suture behind interparietal; a large temporal borders parietal, nuchal scales strongly widened, narrowing gradually after third pair; nostril in a single nasal, which is placed diagonally; two frenals, anterior slightly higher than posterior; two preoculars, lower largest, followed by two small scales above labials; four supraoculars, the second widest, anterior and posterior triangular; nine superciliaries; seven upper labials, fifth entering orbit; four enlarged temporals; mental shaped like rostral, but larger; a large postmental bordered by two labials; a pair of enlarged chin shields longer than wide, forming a long suture; these followed by two pairs of divided shields; six lower labials; lower eyelid with a large transparent scale; snout one and a half times as long as length of orbit; auricular opening well defined; tympanum moderately sunk; legs weak, the adpressed legs failing to meet by a considerable distance; legs with five clawed digits; about thirteen lamellæ under each of the two middle fingers; twenty-three lamellæ under longest toe; scales in twenty-two rows around middle of body, the two median rows much widened; two distinctly enlarged preanals.

Color in life.—Above light brown, with a dark brown lateral band on each side covering parts of two scale rows; the lower part of sides, belly, and underside of head and tail flesh color.

Measurements of the type and cotypes of Siaphos herrei sp. nov.

	No. 208	No. 207.	No. 209.
	mm.	*mm.*	*mm.*
Total length	92.0	54.0	43.2
Snout to vent	41.0	39.0	38.2
Snout to eye	2.5	2.6	2.5
Snout to ear	7.0	7.0	6.7
Snout to foreleg	13.5	13.5	13.5
Axilla to groin	22.0	22.0	22.0
Width of head	4.5	5.0	4.3
Foreleg	8.5	8.0	8.0
Hind leg	12.0	12.2	12.0

Variation.—The specimens are very similar in most details. No. 207 has the internasal and the left prefrontal partially joined as the result of an injury; a very young specimen, No.

211 (snout to vent, 22 millimeters), has the interparietal enlarged and the posterior supraoculars broken abnormally.

Remarks.—This species differs from the other species of the genus in having a divided frontoparietal. In general it agrees most closely with *Siaphos auriculatum* Taylor, of Negros, and *S. kempi* Taylor, of Mindoro. The species is an arboreal one and was found in the root masses of the large bird's-nest fern *Asplenium nidus* and in *Pandanus* trees. The type specimen was captured just outside of the old wall that surrounds the town of Polillo. Six specimens were found.

The species is named for my esteemed friend Dr. Albert C. Herre, chief of the division of fisheries, Bureau of Science, Manila, who has kindly coöperated in making collections.

SNAKES

Typhlops suluensis Taylor.

Typhlops suluensis TAYLOR, Philip. Journ. Sci. § D 13 (1918) 257; Snakes of the Philippine Islands (1922) 61, text figs. 1 and 3.

A specimen (No. 1587, E. H. Taylor collection) of this rare species, heretofore known only from the type, was captured on Basilan Island. It was found under the loose bark of a growing forest tree, 2 meters from the ground. The specimen agrees with the type in most details. The following are the measurements and scale counts of the Basilan specimen:

Measurements and scale counts of Typhlops suluensis Taylor.

	No. 1587.	Type.
Total length ..... mm	390	340
Tail ..... mm	14	13
Width of tail ..... mm	5.5	5.5
Width of body ..... mm	7.6	7.4
Width of head ..... mm	6.5	5.5
Tail width in tail length ..... times	2.5	2.4
Body width in body length ..... do	51	46
Tail length in body length ..... do	28	26

Remarks.—The specimen agrees with the type save that the interparietal is broken into two parts. The median ventral row of scales is clearly differentiated. The underside of the tail is darker than the rest of the underside of the body. The differentiation of the median ventral series of scales of this species distinguishes it from other Philippine species of the genus.

Typhlops cumingii (Gray).

Onychophis cumingii GRAY, Cat. Liz. Brit. Mus. (1845) 133.
Typhlops cumingii TAYLOR, Snakes of the Philippine Islands (1922) 66, text fig. 4.

Two specimens of this rare species were collected on Polillo Island in July, 1920. Most of the specimens of these long-tailed species that I have collected have been found in root masses of aërial ferns. Whether or not aërial root masses are the normal habitat of *Typhlops* I cannot say. However, my own experience in collecting has given evidence that such is the case. In Mindanao all but two specimens of the numerous species of *Typhlops* that I found were collected from the root masses of aërial ferns. Accordingly, in Polillo I began a systematic search for the species within the fern roots, sending my assistants into trees to cut the ferns from their resting places, then cutting the tough masses to pieces when they had fallen. From more than one hundred root masses so treated two specimens of *Typhlops cumingii,* three of *Typhlops braminus,* two of *Haplonodon philippinensis,* and a new species of lizard, *Siaphos herrei,* were captured.

Measurements and scale counts of Typhlops cumingii (Gray).

	No. 300.	No. 299.
Total length ..... mm..	453	373
Tail ..... mm..	27	25
Width of body ..... mm..	8	7
Width of tail ..... mm..	6	5.8
Width of head ..... mm..	6.5	5.7
Depth of head ..... mm..	4	4
Scales on belly from mouth to vent, approximately ..... mm..	480	496
Scales under tail ..... mm..	40	39
Scale rows on body ..... mm..	26	24
Tail width in tail length ..... times..	4.5	4.8
Body width in body length ..... do....	56.5	53.2

Variation.—The rostral is slightly more than one-half as wide as the head and fails to reach the level of the eye by a very slight distance.

Dryocalamus mccroryi sp. nov.

Type.—No. 1517, E. H. Taylor collection; collected at Abungabung, Basilan (on the southern coast), October 23, 1920, by E. H. Taylor.

Description of type.—Rostral distinctly broader than high, forming its longest suture with internasals, only slightly visible above; internasals about as wide as long or a little longer, forming their longest sutures with prefrontals, the suture with nasals curved; prefrontals about as long as wide, broadly in contact with loreal and nasal; frontal one and two-thirds times as long as broad, longer than its distance from tip of snout, slightly

wider than the widest part of supraocular; parietals one and two-thirds times as long as wide, forming a suture for about four-fifths their length, truncate behind; nasal large, irregular, partially divided, posterior part largest, much higher than anterior part; an elongate loreal, more than twice as long as wide, entering orbit; one preocular; supraocular much shorter than frontal, much wider posteriorly than anteriorly; two postoculars, upper square, touching parietal, lower higher than upper; two anterior temporals, followed by three, then by four; the last superior temporal much the largest; three temporals bordering parietals; nine upper labials, fourth and fifth entering orbit; mental much broader than deep; two pairs of chin shields, anterior much longer and wider than posterior, five labials touching anterior; ten lower labials, the last lower and upper labial not well differentiated; eye moderate, its diameter nearly equal to its distance from nostril; pupil vertically elliptic; scales in seventeen smooth rows, without apical pits; ventrals, 220, keeled laterally; anal single; subcaudals, 121, in two rows; head distinct from body, flattened; tail very slender.

Color in life.—Snout black, growing brown on parietals; a V-shaped white mark bordering the posterior edge of frontal; a black mark begins on posterior edge of parietals and continues on neck; a black mark below eye continues back to eighth labial; lip light, flecked with darker; chin and neck white; anterior part of lower lip flecked with dark; body with fourteen elongate, irregularly edged, black, saddlelike blotches which are narrowed laterally, reaching the edges of the ventrals; these blotches cover twelve scales longitudinally, and are separated by smaller white rings which are four to five scales long medially but cover as many as eight scales laterally, the last two white rings with black spots; tail with nine black blotches which encircle tail toward its end; belly white.

Measurements of Dryocalamus mccroryi sp. nov.

	mm.
Total length	350
Snout to vent	258
Tail	92
Width of head	8
Length of head	13
Width of neck	4.5

Remarks.—The species here described fails to agree with the generic characters assigned to *Dryocalamus* by Boulenger, as follows: There are seventeen scale rows instead of thirteen to fifteen; no apical pits on the scales; the dentition of the maxillary differs in that there are eleven or twelve teeth, increasing

in size to eighth or ninth, and then one or two smaller teeth, followed by one or two larger. The general arrangement of the dentition resembles that of *Stegonotus* Duméril and Bibron, but the number of teeth is much less. In general configuration, the relation of the loreal and the preocular, and even in markings, the species appears nearest to *Dryocalamus gracilis* Günther. I have not ascertained whether "one or two more or less distinct tooth-like knobs on the basisphenoid" [5] are present or not, as I hesitate to mutilate the type. The specimen was taken lying quietly in sunlight at the base of a stump in the forest, only a few meters from the sea. Only a single specimen was found.

The species is named for Mrs. Ida M. McCrory, of Manila, who has assisted me greatly in making collections.

Haplonodon philippinensis Griffin.

Haplonodon philippinensis GRIFFIN, Philip. Journ. Sci. § D 5 (1910) 212, text fig. 1, pl. 1; TAYLOR, Snakes of the Philippine Islands (1922) 126, pl. 9, fig. 13.

Two specimens of this rare snake were taken on Polillo Island in July, 1920. They were found in the root masses of the aërial fern *Asplenium nidus*. Two other specimens observed in similar localities escaped. The measurements and scale counts follow:

Measurements and scale counts of Haplonodon philippinensis Griffin.

	No. 319.	No. 320.
Length ..... mm.	550	333
Snout to vent ..... mm.	394	242
Tail ..... mm.	156	91
Width of head ..... mm.	9	7
Length of head ..... mm.	15	11
Ventrals	210	209
Subcaudals	121	122

Remarks.—In general conformation the specimens agree with the type. No. 319 has the loreal broken in two on the right side, leaving two preoculars, and on the left the fifth labial is broken, making a third preocular; the nasal appears to be partially divided. There are 88 spots on the dorsal surface. In No. 320 the loreal is broken on both sides, leaving two preoculars, the loreal not entering the eye. There are 96 spots along the back.

A single specimen has just been received from Itbayat, Batan Islands. It agrees with No. 320 in having the loreal broken

[5] Boulenger, Cat. Snakes Brit. Mus. 1 (1893) 369.

on both sides. The specimen is larger and the head is proportionately broader than in either of the Polillo specimens.

Hologerrhum philippinum Günther.

Hologerrhum philippinum GÜNTHER, Cat. Col. Snakes (1858) 186; TAYLOR, Snakes of the Philippine Islands (1922) 116, pl. 7.

During my past two years' collecting, specimens of this rare snake have been found in four localities: Polillo Island (Nos. 297 and 298); Kalinga, northern Luzon (Nos. F735, F937, F932); Mount Mariveles, Bataan Province, Luzon (Nos. 1781 and 1782); and Mount Maquiling, Laguna Province, Luzon (No. 1873). Eight specimens were taken altogether.

Measurements and scale counts of Hologerrhum philippinum Günther.

No.	Sex.	Total length.	Snout to vent.	Tail.	Length of head.	Width of head.	Ventrals.	Subcaudals.
		mm.	*mm.*	*mm.*	*mm.*	*mm.*		
297	------	324	256	68	14	8	136	47
298	------	178	142	36	9.5	5	138	48
735	♀	360	286	74	14	8	151	49
937	♀	402	325	77	15	8	151	46
932	♀	354	287	67	14	7	154	46
1781	------	305	249	56	13	7.5	150	43
1782	------	274	228	[a]46	12	7	153	42
1873	------	210	165	45	9	6	146	49

[a] Tip missing.

Variation.—The markings agree very well with those given in the drawing of the type; the color varies rather markedly. No. 735, bright reddish to orange brown, darker anteriorly; belly bright reddish salmon, lighter anteriorly; underside of head dusky, with milk-white spots; stripe on side of head cream yellow. The specimen was found crawling in the open along a path. Nos. 1781 and 1782 when taken were reddish brown above, below dirty white, growing pinkish anteriorly. These specimens were taken under rocks in the edge of a small brook. No. 1873 was taken under a log. The cream line on the side of the head has a pink area below it. Dim lines of minute yellow dots are present on each side of the anterior dorsal part of body; belly uniform coral to red. The blackish dots on the outer edge of ventral scales are associated with a small milk-white spot.

Pseudorhabdium minutum sp. nov.

Type.—No. F772, E. H. Taylor collection; collected at Balbalan, Kalinga, Mountain Province, Luzon, April 25, 1920, by E. H. Taylor.

Description of type.—Rostral very narrow, small, higher than wide, minutely visible above, not as wide as mental; internasals five-sided, small, about one-third the size of prefrontals, the sutures with nasal and prefrontal equal, forming their shortest sutures with loreal; prefrontals five-sided, entering eye, sutures with frontal and loreal nearly equal; the sutures formed with internasals transversely straight, those with frontal together form a slight angle; frontal broader than long, the anterior edge only very slightly angular, not reaching anterior to eyes; parietals more than twice as long as wide, forming a mutual suture for more than half their length; nostril pierced in a partially divided nasal; postnasal present on right side (fused with loreal on left); loreal large, much elongate, entering eye on right side, failing to do so by a short distance on left side; supraocular small, as long as eye, longer than broad; a small postnasal; five upper labials, third and fourth entering eye, fifth very large, touching parietal; two temporals posterior to fifth labial bordering parietal; a scale directly behind fifth labial might be regarded a sixth labial save that it appears to be behind angle of mouth; mental moderate, touching anterior chin shields, which are nearly three times as long as wide; posterior chin shields about half as long as anterior, forming a mutual suture for less than half their length; five lower labials, three touching anterior chin shields; ventrals, 140; anal single; subcaudals, 15; scales smooth, in fifteen rows, without apical pits.

Color in life.—Deep ultramarine with yellow-green to blue iridescence; a spot on the chin cream; ventrals each with a bluish band followed by a lighter area; parietals darker than body; a few yellowish spots in front of anus; underside of tail colored as on back.

Measurements of Pseudorhabdium minutum sp. nov.

	mm.
Total length	150
Snout to vent	139
Tail	11
Width of head	5
Length of head, to parietals	6
Width of body	5

Remarks.—The species is related to *Pseudorhabdium mcnamaræ* Taylor but differs in numerous characters. The tail of this new species is proportionately much shorter, with fewer ventrals; the markings and color are different; the frontal is shorter and truncate in front, and the rostral is smaller. It is impossible to tell whether the presence of a postnasal is the

normal condition or not. Only the type was found. It was taken under a small log, in deep forest, immediately behind the town of Balbalan.

Typhlogeophis ater sp. nov.

Type.—No. 1103, E. H. Taylor collection; collected near Pasananka, Zamboanga, Mindanao, September 28, 1920, by E. H. Taylor.

Description of type.—Snout pointed, rostral higher than broad, distinctly visible above; internasals small, about equal to one-fourth the prefrontals, their mutual suture less than one-third the length of that between prefrontals, in contact with second labial; prefrontals large, touching two labials laterally, and ocular scale; no loreal; no preocular; frontal much broader than long, the anterior edge forming a straight transverse line on a level with eyes; frontal about one-half the length of parietals, very broad, in contact with ocular; parietals elongate, nearly twice as long as wide, forming a mutual suture for more than half their length; nostril between first labial, which is fused with the anterior nasal, and a small nasal; five upper labials, third and fourth bordering ocular, which covers eye; the scale has a rounded, transparent prominence on anterior part, through which the eye is distinctly visible; no postocular distinct from ocular; no anterior temporals; one large posterior temporal bordering parietals, with two enlarged scales below it; no supraoculars; mental small, three times as wide as deep; two pairs of chin shields, the anterior about three and one-half times the size of second pair; three labials touching chin shields (four on right side); five lower labials. Ventrals, 113, not keeled or angular; subcaudals, 33; anal single; tail slender, pointed; scales smooth, in 15 rows, without apical pits.

Measurements of Typhlogeophis ater sp. nov.

	mm.
Total length	173
Snout to vent	143
Tail	30
Width of head	4.5
Length of head	8
Width of body	4

Color in life.—Uniform blackish brown, somewhat iridescent above; belly and region under tail slightly lighter blackish brown; head colored like body.

Remarks.—The genus *Typhlogeophis* was created by Günther for *T. brevis* Günther, a species founded on a single specimen collected by A. Everett, supposedly on Mindanao or Dinagat

Island. The species here described differs markedly from *T. brevis*. In *T. ater* there are 40 ventral scales less on the belly and 18 more subcaudals; the frontal is wider than long; the eye is visible through the transparent ocular; there is a striking difference in the relative sizes of the chin shields; the tail is long and slender; the scales and shields are not white-edged. The ocular scale appears as a fusion of two elements, the postocular part is distinct, and there is a slight depression between this and the rounded, moundlike, transparent part covering the eye.

My specimen was taken in a small brook that empties into Tumugao River just above the waterworks' intake near Pasananka, Zamboanga. It was found under a partly submerged log in wet earth. It was very active, and escaped over a waterfall. It was found again only after a long, diligent search.

Calamaria joloensis sp. nov.

Type.—No. 1855, E. H. Taylor collection; collected in central Jolo, October 30, 1920, by E. H. Taylor.

Description of type.—Rostral broader than deep, distinctly visible from above; prefrontals large, longer than wide, forming lateral sutures with nasal, two labials, and preocular; frontal six-sided, very pointed behind, large, distinctly longer than its distance from end of snout, longer than wide, at least three and one-half times the width of supraocular; parietals large, forming a mutual suture for little more than half their length; nasal extremely small, triangular; one small preocular; supraocular not quite twice as long as wide; one small postocular; no anterior temporals; diameter of eye slightly less than its distance from mouth; five upper labials, third and fourth entering eye, fifth very large, forming a long suture with parietals; a single posterior temporal; two scales following parietals distinctly enlarged; mental small, in contact with chin shields; four lower labials; chin shields partially grown together; scales in 13 rows; ventrals, 120; subcaudals, 14; anal single.

Color in life.—Above blue-black to purplish black, highly iridescent; below lavender to black with lighter cream-colored areas along anterior part of belly.

Measurements of the type of Calamaria joloensis sp. nov.

	mm.
Total length	150
Snout to vent	140
Tail	10
Width of head	4

Remarks.—This single specimen was taken on Jolo Island, under a rock in a small dry brook. I do not believe an apology is necessary for adding this species to the already very large assemblage of species of *Calamaria*. The very low ventral count and the absence of marking easily differentiate it from other Philippine species of the genus. The species seems to be nearer *Calamaria prakkii* Lidth de Jeude, from which it differs in color, the very much shorter tail, and the very much smaller number of subcaudals.

Calamaria grayi Günther.

Calamaria grayi GÜNTHER Cat. Col. Snakes (1858) 6; TAYLOR, Snakes of the Philippine Islands (1922) 184.

A specimen of this rare species (No. 1034, E. H. Taylor collection) was taken at Zamboanga, near Pasananka, in a small stream that enters Tumugao River above the waterworks' intake. It was found under a rock which was at the water's edge. The species varies from Boulenger's description, in that the head is flattened and distinct from the neck, and the frontal is twice the width of the supraoculars.

Color in life.—Head dirty white to yellow-cream with a brown band between the eyes and involving the eye; grayish markings on the prefrontals and the rostral; the anterior part of the body has grayish rings, one scale wide dorsally and covering three or four ventrals below; toward the posterior part of the body the light rings are broken, and a series of gray spots follows the median line; below, the posterior part of the body is like the anterior. Ventrals, 191; subcaudals, 18; anal single.

Measurements of Calamaria grayi Günther.

	mm.
Total length	195
Snout to vent	183
Tail	12
Width of head	5
Width of neck	4

Remarks.—In my monograph on Philippine snakes [6] I state that only the types have been collected. This statement is doubtless erroneous, since Steindachner [7] records *Calamaria philippinica*, which is regarded as a synonym of this species.

[6] Snakes of the Philippine Islands, Bureau of Science publication 16 (1922) 312.

[7] Verh. Zool. Bot. Ges. Wien 17 (1867) 13, figs. 4–6, a paper which I have not seen.

ILLUSTRATIONS

PLATE 1

FIG. 1. *Philautus basilanensis* sp. nov. Photograph of cotype (No. 1699A). Actual size of specimen, snout to vent, 22 millimeters.

2. *Philautus basilanensis* sp. nov. Photograph of type (No. 1510). Actual size, snout to vent, 21 millimeters.
3. *Philautus williamsi* sp. nov. Photograph of cotype from Polillo (No. 358). Actual size, snout to vent, 15 millimeters.
4. *Philautus williamsi* sp. nov. Photograph of type from Polillo (No. 356). Actual size, snout to vent, 21 millimeters.
5. *Philautus williamsi* sp. nov. Photograph of cotype from Polillo (No. 359). Actual size, snout to vent, 15 millimeters.
6. *Philautus williamsi* sp. nov. Photograph of cotype from eastern coast of Luzon. Actual size, 15 millimeters.
7. *Philautus zamboangensis* sp. nov. Photograph of type (No. 1059). Actual size, snout to vent, 28 millimeters.

PLATE 2. PHILAUTUS POLILLENSIS SP. NOV.

FIG. 1. Photograph of cotype (No. 353). Actual size, snout to vent, 19 millimeters.

2. Photograph of cotype (No. 352). Actual size, snout to vent, 15 millimeters.
3. Photograph of type (No. 351). Actual size, snout to vent, 27 millimeters. The folds across the snout and between the eyes are not normal.
4. Photograph of cotype (No. 350). Actual size, snout to vent, 20 millimeters.

PLATE 3

FIG. 1. *Kaloula kalingensis* sp. nov. Photograph of type (No. 824). Actual size, snout to vent, 36.5 millimeters.

2. *Kaloula kalingensis* sp. nov. Photograph of cotype (No. 856). Actual size, snout to vent, 34 millimeters.
3. *Kaloula negrosensis* sp. nov. Photograph of cotype (No. 538A). Actual size, snout to vent, 29.5 millimeters. The photograph fails to show very characteristic markings on the back.
4. *Kaloula negrosensis* sp. nov. Photograph of type (No. 538). Actual size, snout to vent, 30 millimeters.
5. *Kaloula rigida* sp. nov. Photograph of cotype from Baguio (No. 710). Actual size, snout to vent, 46 millimeters.
6. *Kaloula rigida* sp. nov. Photograph of type (No. 768) from Kalinga. Actual size, snout to vent, 47 millimeters.

PLATE 4

FIG. 1. *Megalophrys hasselti* (Tschudi). Photograph of a specimen from Abung-abung, Basilan (No. 1597A). Actual size, snout to vent, 55 millimeters.
2. *Bufo mcgregori* sp. nov. Photograph of type (No. 1468A). Actual size, snout to vent, 37 millimeters.
3. *Bufo mcgregori* sp. nov. Photograph of cotype (No. 1468B). Actual size, snout to vent, 37 millimeters.

PLATE 5

FIG. 1. *Gekko smaragdinum* sp. nov. Photograph of type specimen. Actual length, body and tail, 133 millimeters. The very characteristic black spots on the anterior part of the body are scarcely evident in the photograph.
2. *Gekko porosus* sp. nov. Photograph of type. Actual length, body and tail, 111 millimeters.

PLATE 6. DRYOCALAMUS MCCRORYI SP. NOV.

FIG. 1. Drawing of head of type, side view. × 3.
2. Drawing of head of type, top view. × 3.
3. Photograph of type specimen. Actual length, 350 millimeters.

PLATE 7

FIG. 1. *Siaphos herrei* sp. nov. Drawing of head of type, top view. × 4.
2. *Calamaria joloensis* sp. nov. Drawing of head of type, side view. × 4.
3. *Calamaria joloensis* sp. nov. Drawing of head of type, top view. × 4.
4. *Pseudorhabdium minutum* sp. nov. Drawing of head of type, side view. × 4.
5. *Pseudorhabdium minutum* sp. nov. Drawing of head of type, top view. × 4.
6. *Typhlogeophis ater* sp. nov. Drawing of head of type, side view. × 4.
7. *Typhlogeophis ater* sp. nov. Drawing of head of type, top view × 4.

PLATE 1. NEW SPECIES OF PHILAUTUS.

1

2

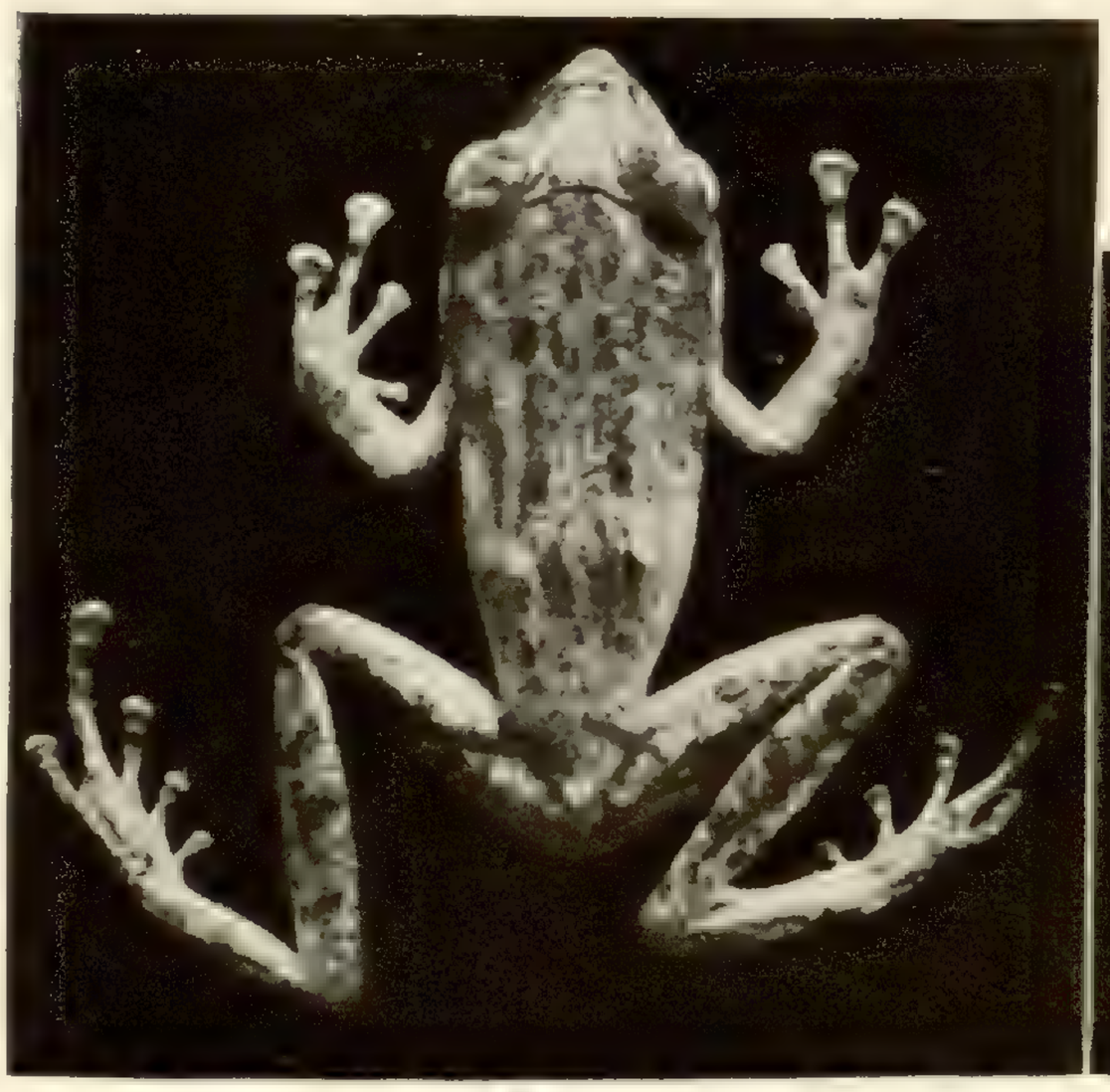

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PLATE 2. PHILAUTUS POLILLENSIS SP. NOV.

PLATE 3. NEW SPECIES OF KALOULA.

PLATE 4. PHILIPPINE TOADS.

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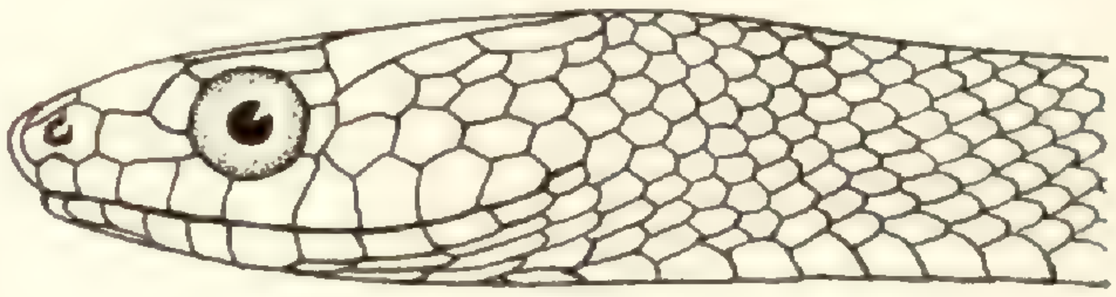
PLATE 5. NEW SPECIES OF GEKKO.



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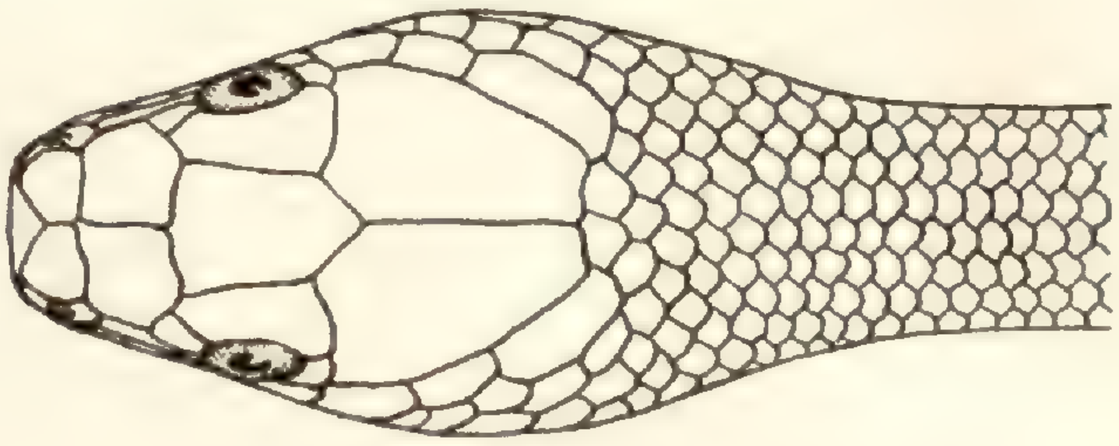

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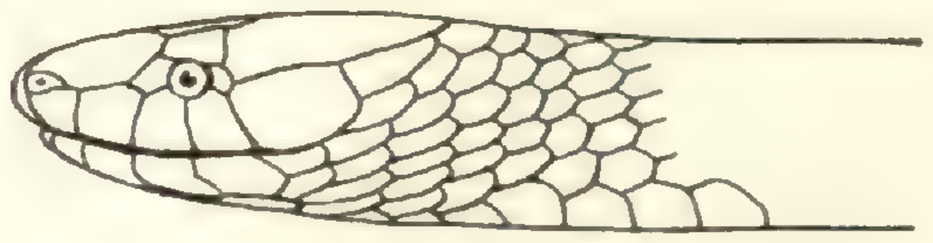
PLATE 6. DRYOCALAMUS MCCRORYI SP. NOV.

1



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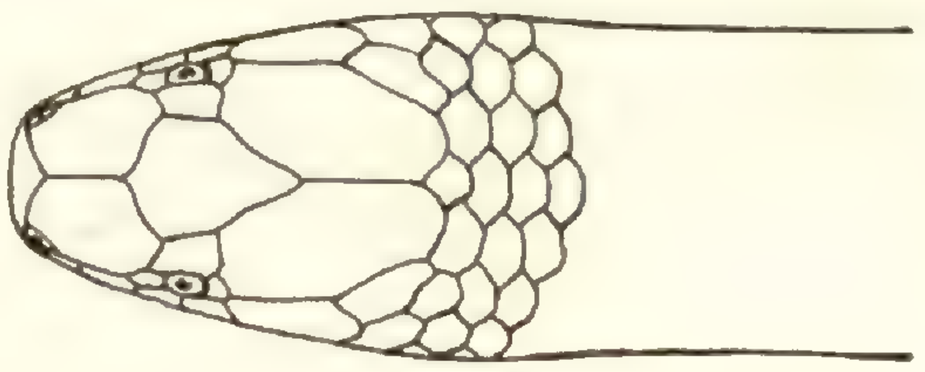

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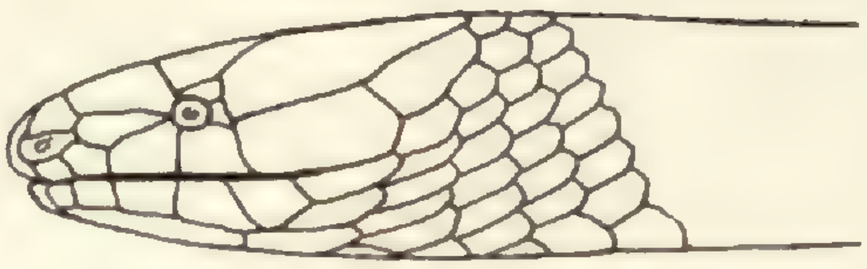

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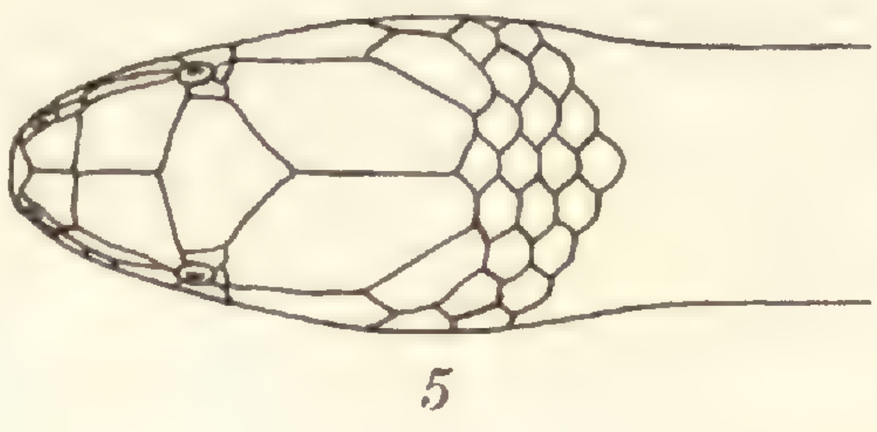

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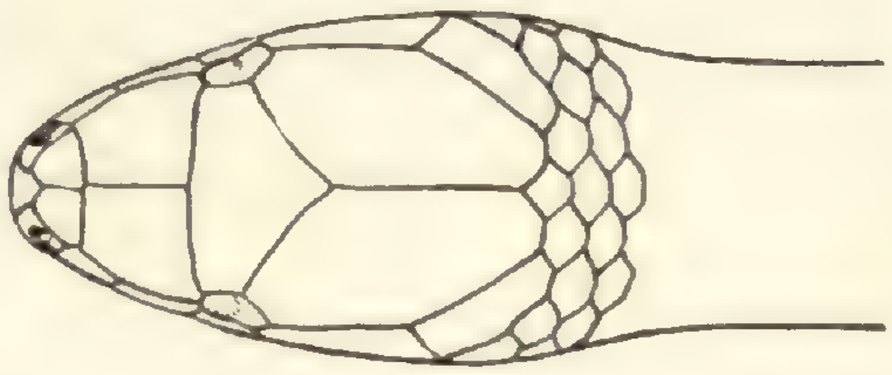

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PLATE 7. NEW PHILIPPINE REPTILES.

COPELANDOSPHAERA, A NEW GENUS OF THE VOLVOCACEAE

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FOUR PLATES AND TWO TEXT FIGURES

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INTRODUCTION

In collections of the Volvocaceae made in the vicinity of Manila during the latter months of 1914 and 1915 there occurs a new member of this family that has the general appearance of a *Volvox*. However, its cells lack the protoplasmic connecting strands that are characteristic of *Volvox*. This, supplemented by other differences, I take as ground for considering it as not properly to be classed as a *Volvox*. It differs from its nearest affinity on one side, *Besseyosphaera*, established by Shaw ('16) and based on the "second form of *Volvox*" described by Powers ('07), in having its gonidia (the asexual reproductive cells) differentiated before the completion of the growth divisions and segmented before the birth of the coenobia in which they occur. It differs from its affinity on another side, *Merrillosphaera*, established by Shaw ('22B) based on *Volvox carteri* Stein ('78) which in turn was originally described by Carter ('59) under the name *Volvox globator*, in having the gonidia not differentiated in an early stage of the embryonic development, not becoming very large before segmentation, and not being symmetrically arranged in pairs or fours.

It may be distinguished from still another similar genus, *Campbellosphaera*, described by Shaw ('19), by the absence of a vacancy in the layer of somatic cells of a mother over the gonidia and the daughters developed from the gonidia. In that genus the gonidia are not formed from cells in the coenobium wall at the places where they are to grow and develop into daughters, but come from the outside of the coenobium to take up places within. In the species which forms the subject of this paper the gonidia are differentiated from the somatic cells late in the prenatal development of the asexual daughters in which they are formed. As they grow they sink below the level of the somatic protoplasts, leaving a vacancy in the layer of protoplasts.

This new species will be treated as the type of a new genus, to be called Copelandosphaera [1] as a token of recognition of the work of Edwin Bingham Copeland on the phylogeny of the ferns of the Oriental Tropics. The first specimens observed were living, and some of them appeared to be setting free their vegetative cells or somatic protoplasts, whence the name *dissipatrix* that will be applied to the species. The use of this name is not intended to imply that the behavior to which it refers is habitual; nevertheless, it may serve to direct attention to a possible recurrence of the phenomenon in this or other species of the family under circumstances that may admit of following the history of the detached vegetative cells.

COPELANDOSPHAERA DISSIPATRIX GEN. ET SP. NOV.

DESCRIPTION OF TYPE SPECIMEN

For the type of *Copelandosphaera dissipatrix* a mature asexual specimen, represented by Plate 2, fig. 6, and Plate 3, fig. 13, has been selected. It is in a Venetian turpentine mount of material that was collected at Pasig, near Manila, in August, 1914. The collection from which the slide was prepared was numbered XVI.[2] The material was stained with a combination of nigrosin and Bismarck brown.

[1] The use of this name was forecast in a footnote of an earlier paper (Shaw '19, p. 513).

[2] The slide bearing the type specimen is in my possession. Slide mounts of material collected not far from the type locality in the same year have been sent to Prof. F. G. Haughwout, Bureau of Science, Manila, P. I., and to Prof. D. H. Campbell, Stanford University, California. Material from the same locality, bottled in glycerine, has been sent to thirty-two biologists in the Northern Hemisphere. Duplicates of this bottled material are available for distribution from my American address: Claremont, California.

The specimen is a globose coenobium containing nine daughters that fill the middle and hindmost thirds of the mother and cause the wall of the rear half of the mother to bulge out into the form of large, closely set bosses.[3] The specimen is compressed under the cover glass to about 400 μ and measures 1,050 μ wide and 1,015 μ long. The number of cells in the mother was estimated at 52,600, the average spacing of the protoplasts being about 8.5 μ. The front of the coenobium is turned away from the observer about 25°.

The somatic protoplasts are ovoid or ellipsoidal. In the front of the coenobium they measure about 5 by 8 μ. At the sides and back they are somewhat smaller. The thickness of the space occupied by the layer of somatic cells with their membranes is about 14 to 19 μ in different parts of the front, and about 10 μ at the back over the daughters.

The nine daughter coenobia are arranged in a way that leaves one vacant space in the back part of the group. Four daughters that lie in the median optical section of the mother press the wall of the latter out to form bosses that are of a height equal to one quarter or more of the diameters of the daughters. The daughters are all more or less ellipsoidal, the smallest measuring 275 by 315 μ and the largest 315 by 365 μ, the average dimensions being 298 by 322 μ. An estimate of the number of cells in the smallest daughter gave 15,000, the protoplasts being about 2.5 μ in diameter and the spaces between about 1 μ.

All of the daughters are asexual. The largest contains ten gonidia of about 21 μ diameter. The smallest contains 2-celled embryos of about 21 μ diameter and 4-celled embryos of about 22 μ diameter. The largest embryos are 8-celled ones measuring 30 μ. The numbers of the reproductive bodies in the daughters are:

> 6, 7, 8, 9, and 10 reproductive bodies in
> 2, 2, 3, 1, and 1 daughters, respectively.

The most-advanced embryos, 8-celled, are in the four daughters that are nearest the front of the mother.

The thickness of the layer of somatic cells of a daughter with their membranes can be made out by direct microscopic observation of the daughter that bulges out on the right side of the mother. There is a line parallel with the peripheral boundary of the daughter and about 10 to 12 μ below it. This is shown in

[3] This bossed condition of the mature asexual coenobium is partly, if not wholly, a result of the manner in which the shrinkage produced by the mounting medium has taken place.

fig. 1. The protoplasts are in less than the outer half of the space between these two limits. Where a gonidium or embryo occurs in the median optical section of the daughter the inner boundary of the somatic membranes is deflected inward to form a lenticular thickening just thick enough to include the reproductive body between its inner limit and the layer of somatic protoplasts. Such a 2-celled embryo measured 18 μ thick and about 23 μ wide. This embryo, then, if my interpretation of the line *i'* in fig. 1 be correct, occupies the center of a lenticular thickening of the body wall of the daughter that is equal in thickness to the radial dimensions of the peripheral lamella, the somatic protoplasts, and the embryo combined.

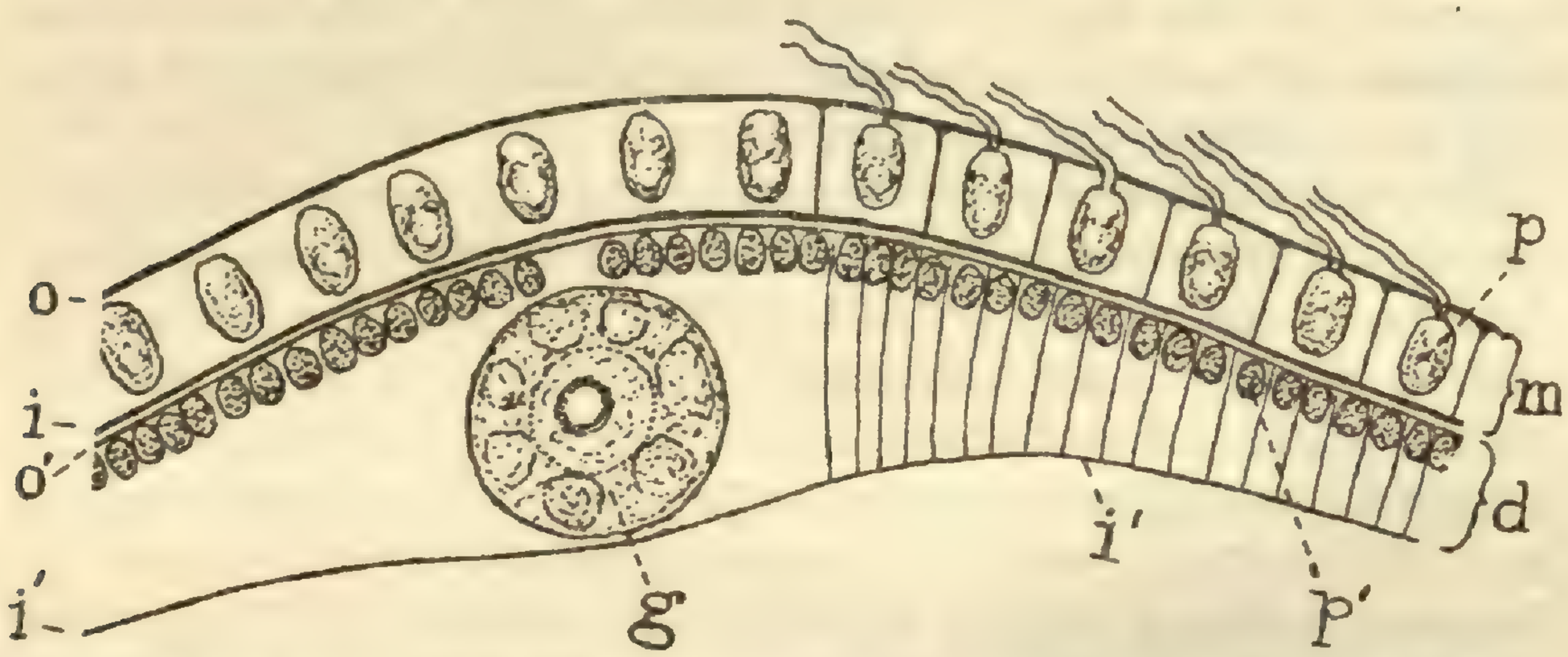

FIG. 1. Optical section through mother and daughter coenobia of the type specimen in Venetian turpentine. In the right half of the figure the invisible bounding lamellae of the separate cells are drawn as they are supposed to be. The somatic wall, *m*, of the mother with its protoplasts, *p*, is included between its outer membrane, *o*, and its inner membrane, *i*. The wall, *d*, of the daughter between its outer, *o'*, and inner, *i'*, membranes contains the layer of smaller protoplasts and the gonidium, *g*. Semidiagrammatic. × 1,000.

None of the 8-celled embryos are in positions that are favorable for showing the inner limit of the membranes of the coenobial wall.

Embedded in the coenobium wall are numerous endophytic algae of a species probably belonging to the genus *Chlorosphaera* Klebs. They are most numerous on the front of the coenobium and are present in a great variety of stages.

OTHER ASEXUAL COENOBIA

A less-mature coenobium (specimen 2) with daughters nearly or fully formed is shown in Plate 2, fig. 9. This is on the same slide as the type specimen. The coenobium measures 535 by 525 μ, and the daughters range from 140 by 174 to 190 by 200 μ. There are ten daughters. They are more nearly in two circles of five each than in fours or pairs, but the members of a

circle are not all in the same plane. The daughters have apparently completed their growth divisions, and gonidia can be seen in all but two; these two I believe to be sexual daughters. Measurements of somatic cells were made in three daughters and of gonidia in eight. For the somatic cells the measurement is space per cell obtained by measuring a straight row of five cells and dividing by five. The gonidia in any one daughter are of about the same size. Examples showing the extremes are:

Width of somatic cells	2.9, 3.2, 3.2 μ
Diameter of gonidia	5.0, 8.6, 11.0 μ

The gonidial protoplasts are sunk below the level of the somatic protoplasts. Over each daughter on the nearer side of the mother the vacancy in the layer of somatic protoplasts of the mother forms an elongated space that is surrounded by seven or eight protoplasts.

Specimen 2A.—On the same slide with the previously described specimens there is a very much shrunken mother coenobium with six daughters that are plump. One of these is asexual, and five are sexual. The somatic cells of the mother measure about 5 μ wide. The asexual daughter measured about 225 by 255 μ, consisted of about 23,000 cells about 3 μ wide, and contained five gonidia that ranged from 18 to 21 μ in diameter. The sexual daughters ranged in size from 230 by 245 to 230 by 265 μ, and in number of cells from about 13,000 to about 26,000. The reproductive bodies measured about 9 μ in diameter in the sexual daughters, and in one they were estimated to number about 190.

Most of the micrographs used to illustrate the species were made from material collected at Pasay, near Manila, from a pond called J for labeling material from that source. The material was collected October 13, 1914, and mounted in glycerine. The photographed specimens will be described first.

Specimen 3.—Plate 2, fig. 8. This is a young coenobium with fifteen embryonic daughters in about the 64-celled stage. The photograph shows that the phialopores of the embryos, each of which is directly under the vacant space in the somatic layer of the mother, are still open. The mother measures about 346 μ both ways. The protoplasts are about 4 to 5.5 μ wide. Their spacing is about 10 μ, and the number of cells is about 4,300. The daughters measure about 29 to 43 μ in diameter.

Specimen 4.—Plate 2, fig. 10. This coenobium, shown on a smaller scale, contains eight more-advanced embryos. The

mother measures 560 by 604 μ. The cell spacing is about 9 μ, and the number of cells is about 14,700. The embryo daughters measure from 62 to 75 μ and have their cells about 7 μ wide. The number of cells in these embryos is between 256 and 512.

Specimen 5.—Plate 2, fig. 7. This coenobium, which also is shown on a smaller scale, contains four embryo daughters. The mother measures about 472 by 517 μ. The cell spacing is about 12 μ, and the number of cells is about 6,000. The daughters measure about 125 by 118 μ, being wider than long, and their average cells measure about 6 by 9 μ and have very thin walls. The number of their cells is about 1,024; that is to say, ten divisions have been accomplished. The capsules of the daughters are separated from their somatic cells by distances of about 10 μ around the equators, but are in contact with both poles of the daughters.

Specimen 6.—Plate 3, fig. 11. A coenobium with ten embryo daughters. The preparation bearing this and the next specimen dried up before measurements were made. From the picture we find the dimensions to be about 590 by 620 μ; the spacing of the cells, about 9 μ; and the number of cells, about 16,000. The embryo daughters are about 100 and 110 μ in diameter.

Specimen 7.—Plate 4, fig. 16. This is a more-mature coenobium with only six daughters. Measurement of the photograph gives dimensions of 630 by 700 μ and cell spacing about 12 μ. The number of cells is about 10,900. The largest daughter measures about 200 by 230 μ.

Specimen 8.—Plate 4, fig. 14. A less-mature coenobium with ten daughters. The mother measures about 680 by 720 μ; it has cells spaced about 12 μ and numbering about 12,000. The daughters are about 130 to 160 μ in diameter. The unclosed phialopores of the two nearer daughters can be seen in the picture. In all observed cases this opening is directly underneath the vacant space left in the somatic layer by the cell that became the gonidium.

YOUNG COENOBIA

In both of the collections from which the specimens already described were selected there occur sexual coenobia. In the glycerine preparations from Pond J they are present in a great variety of stages, from unborn to nearly mature. They occur in the same mother with asexual daughters in various proportions. Measurements of some of these will serve to show

the condition of the two kinds of coenobia before and at the time of birth.

Specimen 9.—A very nearly mature coenobium (not figured) with one sexual and five asexual daughters is very much shrunken, though the daughters are not. The sexual daughter measures 257 by 287 μ, has somatic protoplasts about 3.5 μ, and numerous oogonidia of about 12 μ. The largest asexual daughter measures 272 μ each way and has six gonidia of which some are undivided and others divided into two cells. These gonidia measure about 20 to 22 μ. The smallest daughter measures 215 by 236 μ and has seven gonidia that measure about 18 μ.

Specimen 10.—An overmature coenobium (not figured) with two remaining daughters, both asexual. The mother is much shrunken and has large holes in the wall. The daughters are terete. One daughter presents a side view and measures 280 by 310 μ, and contains ten embryos that are 8-celled and measure about 25 μ. The embryos of the other daughters are of the same number, size, and stage.

Specimen 11.—A glycerine preparation of material from Pond E in Pasay on October 12, 1914, bears an abundance of material of this species of which one specimen should be noted here. It is a very mature, somewhat shrunken coenobium (not figured) with three remaining daughters caught at the time of fixing the material in the act of passing out, each through its own hole in the wall of the mother. About one-fourth to one-third of each is out. The two sexual coenobia are coming out forward end first, and the asexual one is coming out hind end first. The asexual daughter measures 345 by 385 μ and contains seven embryos that are 8- or 16-celled and measure 29 μ wide. The sexual daughters measure 365 by 440 μ and 370 by 460 μ and have numerous oogonidia of about 15 to 17 μ and of about 14 μ, respectively.

In the young sexual coenobia that have been described the reproductive cells are all of about the same size in each coenobium, and have apparently been formed from cells of the body layer after the last cell division of growth, for the vacant space left when the oogonidial protoplast sank below the level of the somatic layer is not much larger than that occupied by each neighboring somatic cell. The gonidia, on the other hand, appear to have been differentiated before the last division, but precisely when is still an unanswered question.

MATURING SEXUAL COENOBIA

We will pass to a consideration of sexual coenobia that are approaching maturity and describe the one [4] that is represented by Plate 1, figs. 1 to 3. This and the two sexual coenobia that are shown on the next plate are in the lot of glycerine preparations that were made from the Pond J material from Pasay, October 13, 1914.

Specimen 12.—Plate 1, fig. 1, shows a sexual coenobium with antheridia very nearly mature. This specimen is a slightly ovoid coenobium about 610 by 660 μ. The number of cells forming the coenobium was estimated to be about 17,600. The protoplasts of the cells are ovoid and measure about 6 by 7 μ in the front and 4 by 5 μ in the middle and back of the coenobium. The distance between the protoplasts is greatest in the front and grades to the minimum at the back. The oogonidia when counted in a camera lucida sketch were found to be 127. They are distributed in about three-fourths of the length of the coenobium and are slightly more crowded in the hindmost quarter than elsewhere. They are globular and measure about 28 μ in diameter. Their outer sides are only about 10 μ below the outside surface of the coenobium. The antheridia that can be seen are ten, and they are not all grouped in pairs like the four shown in the photograph. Each antheridium consists of a platelet about 37 μ wide and 10 μ thick, slightly dished, consisting of about 256 closely packed sperms.[5] The vacant spaces in the coenobium wall over the two antheridia that can best be seen are large enough to have seven protoplasts around them. They are, if different, larger than the spaces above the oogonidia, most of which seem to have not much more than six protoplasts around them.

Specimen 13.—Plate 2, fig. 4, shows a nearly mature sexual coenobium on a smaller scale. The picture was taken with a focus below the middle of the specimen, and the oogonidia that show most plainly are those of the farther side. The coenobium measures 760 by 840 μ, the spacing of the cells is about 10.7 μ, and the number of cells about 19,600. Few antheridial sites can be distinguished in the coenobium wall. The oogo-

[4] This one had been selected, at the time when the figures were made up into plates, to serve as the type of the species, but it is now thought that the characters of the genus are better shown by mature asexual coenobia with their contained daughters.

[5] This number was obtained by finding that the diameter of a platelet is about equal to 18 sperms in a straight row.

nidia are dense and, except one, without spore walls. They are about 46 μ in diameter. The number present is 130. One oospore wall had developed around a reproductive body somewhat smaller than the others, about 41 μ wide, that is of a more orange color than the others. The wall is yellowish and wavy and not very thick. The protoplast has not contracted within the wall of this spore.

Specimen 14.—Plate 2, fig. 5, shows a large sexual coenobium on the same small scale used for the preceding figure. It measures 870 by 973 μ, has its cells spaced about 10.7 μ, and contains about 25,800 cells. There appear to be two empty antheridial sites on the nearer and one on the farther side. The oogonidia are about 46 μ wide and are all dense and without spore walls. They number about 112.

Specimen 15.—In the same Venetian turpentine preparation with the type specimen there is a sexual coenobium that is figured in Plate 4, fig. 15. It is very much shrunken. It contains eighty-one reproductive bodies of which all but ten have more- or less-developed, smooth spore walls from which in some cases the dense portion of the protoplast has contracted. They measure about 42 to 43 μ. Some of them are shown on a larger scale in Plate 3, fig. 12.

OBSERVATIONS ON LIVING SPECIMENS

The paucity of recorded observations in my notes on living specimens of this species is due largely to the fact that in most collections the species was accompanied by several more-puzzling species of the same family. Descriptive data from these notes will be given to supplement those obtained from material in glycerine and Venetian turpentine.

Specimen 16.—A living specimen in a collection from Pasig, August 4, 1914. This was an asexual coenobium with ten daughters and measured 900 by 950 μ. It was observed to have no protoplasmic connections between the cells. The surface of the coenobium was smooth.[6] The protoplasts of the mother measured about 6 μ wide and were estimated to number 13,000. Measured daughters were 220 by 270 μ, 260 by 300 μ, and 270 by 300 μ. The cells of the daughters were about 4 μ in diameter, and the gonidia of the daughters about 18 μ in diameter.

Specimen 17.—On August 5, 1914, observations were made on living material that had been collected at Pasig the day before.

[6] In this respect it differed from *Campbellosphaera*, which was represented in the same collection.

Many of the coenobia showed numerous bald spots of irregular form and varying size. From these spots the cells were gone. Around the borders of these spots some cells appeared to be partly loosened and about to escape. In the morning specimen 17, with very large daughters, was placed in a glass ring under a cover glass. By 1.30 in the afternoon cells had disappeared from a very large area, and the water in the ring was full of green, motile cells of about the same size.

Specimen 18.—August 5, 1914. In material collected the day before and kept in a watch glass an asexual coenobium with eight daughters measured 1,630 by 1,860 μ and was estimated to contain 20,200 cells. The daughters were all in the hindmost half of the mother and were about 370 by 440 μ. The somatic protoplasts of the daughters were about 4 μ wide and almost in contact with one another. The number of these protoplasts was estimated to be 14,820. The gonidia in the daughters were about 28 μ in diameter.

Specimen 19.—August 5, 1914. In the same material as the preceding a sexual coenobium from which the anterior fifth was gone measured (restored) 620 by 660 μ. It contained oogonidia distributed beneath the remaining portion of the coenobium wall. The cells of the coenobium were ovoid and measured about 5 μ wide. The number of cells was estimated to be about 19,450. The oogonidia were about 25 μ wide, and their number was estimated to be about 500.[7]

Specimen 20.—August 20, 1914. In material from Pasig a coenobium with nine daughters measured 1,950 by 2,250 μ. The lateral protoplasts measured 4.5 to 5 μ, and they were 15 to 20 μ apart. The number of cells was estimated to be about 25,900. The daughters were all of about the same size, 450 by 530 μ. The reproductive bodies in the daughters were all embryos of about the same age and size. They measured about 30 μ wide and were 16- or 32-celled spheres, each with an opening (phialopore) of about the size of one cell.

Specimen 21.—December 15, 1917. From living material from Pond E in Pasay one sexual coenobium was mounted in a hanging drop. It measured 800 by 900 μ and consisted of about 10,700 cells. It contained forty-eight orange oospores and four green oogonidia, of which none were in the forward

[7] It was observed that there were about 4 of the oogonidia per area 90 sq. μ which corresponds to about 623 for the whole spheroid. From this number 123 was deducted for the anterior fifth which presumably contained no reproductive cells.

third of the coenobium. The oospores had a smooth outer wall about 46 μ in diameter and a smooth inner wall about 42 μ in diameter. The space between the membranes appeared to be occupied by a substance with large vacuoles.

THE MANNER OF BIRTH

Each daughter coenobia makes its exit from the mother through a separate opening formed in the wall of the mother. This is well illustrated by specimen 11, already described. After the departure of the daughter the opening remains with a smooth outline. This birth of the daughters through separate holes is in striking contrast with the manner of birth in another species that was first observed in the same habitat with *Copelandosphaera*. In that one, the species of *Campbellosphaera*, as has been recorded elsewhere (Shaw, '19, p. 494), the daughters nearest the hinder pole mature first and are liberated one by one through an opening in the back of the mother, through which all the other daughters pass in turn.

A FREAK COENOBIUM

On the same slide with the Pond E material that includes specimen 11 with an abundance of mature and other coenobia there is one specimen, a sexual coenobium with oogonidia a little over half grown, with a deep equatorial constriction, which at first sight appears to have been produced by a birth that was long interrupted when the daughter was halfway out. This coenobium is widened and shortened to 610 by 560 μ. A normal coenobium of about the same age is about 30 μ longer than broad. The furrow is about 70 μ deep on the nearer side of the coenobium, and the sides of the furrow are in contact for some distance from the bottom. The median section effect is that of a closed furrow between two rounded ridges. The furrow is slightly in advance of the equator, and there is one row of reproductive cells in front of it, all the others being on the furrow or behind it. The coenobium wall, then, consists of two nearly equal parts, each with a flange on the inner side of the line of union, the parts being united by the inner edges of the flanges.

Some of the measurements of coenobia and numbers of somatic and reproductive cells are given in Table 1. Certain of the figures greatly exceed the general range of those recorded, yet the table will serve its purpose even though some of the extreme figures are not above suspicion of error.

TABLE 1.—*Sizes of coenobia and numbers of cells in Copelandosphaera dissipatrix gen. et sp. nov.*

ASEXUAL COENOBIA.

Specimen No.	Greatest diameter.	Somatic cells.	Reproductive cells.
	μ.		
20	2,250	25,900	9
18	1,860	20,000	8
Type	[a] 1,050	52,600	9
16	950	13,000	10
8	[b] 720	12,000	10
7	[b] 700	10,900	6
4	[b] 604	14,000	8
6	[b] 590	16,000	10
5	[b] 517	6,000	4
SEXUAL COENOBIA.			
14	[b] 973	25,000	112
13	[b] 840	19,600	130
19	660	19,000	500
12	[b] 660	17,600	127
22 [c]	[b] 680	11,500	60
21	900	10,700	52
24 [c]	[b] 530	10,700	47
25 [c]	[b] 545	9,600	64
23 [c]	[b] 540	9,200	50

[a] Venetian turpentine preparation. [b] Glycerine preparation. [c] Not described.

COPELANDOSPHAERA SPERMATOSPHAERA (POWERS) COMB. NOV.

Powers ('07) gave a description of a form that he distinguished as his "first form of *Volvox*" based on material collected from a shallow remnant of a prairie pond containing considerable alkali. In the following year he extended the description to embrace the characters of material received from the State of Washington, from Missouri, and possibly from Louisiana, and named it *Volvox spermatosphara* Powers ('08). The name was emended by West ('10) to *V. spermatosphaera*. Powers's description is the most complete ever written by the author of any new species of the Volvocaceae, and his beautiful photomicrographic figures mark the beginning of a new epoch in the study of the members of this family. Our knowledge in this field will not begin to be satisfactory until we have similar photographic illustrations of all the known species of the group.

The shape of the coenobia, described by Powers ('08, pp. 145 and 151) as uniformly and strongly oval, might possibly better be characterized as strongly ellipsoidal, for they do not have one end regularly larger than the other as is commonly the case in

Volvox africanus West ('10) which appears in West's photomicrographic figures and in photographs of some of my own material. The coenobia of that species are commonly more truly egg-shaped in having one end, the forward one, larger than the other, and are properly described as ovoid. In *Copelandosphaera spermatosphaera* the ellipsoidal form is strongly marked in the young coenobia, and is evident before birth, except in the sperm spheres, which are spherical (Powers '07, p. 129).

The size of the mature coenobia in Powers's first collection of this species ranged between 500 and 1,000 μ. Material subsequently collected in Nebraska gave maximum dimensions for mature coenobia with vegetative or mixed content of 600 to 650 μ, and for coenobia with oospores alone of about 500 μ. The smallest coenobia containing mature sperm spheres were as small as 150 μ or even smaller. The most frequent size of mature coenobia in a large collection from Missouri was not far from 350 μ. In the larger mothers the size of the daughters at birth was about 250 μ; in smaller ones they frequently escape at 100 μ or less.

The number of cells in the coenobia was estimated by Powers to be between 1,000 and 3,000. When coenobia with smaller numbers of cells produce daughters with larger numbers, the progeny, though present in medium or smaller numbers, fill the entire cavity of the mother and stretch the maternal coenobial wall out of its original shape. This was illustrated by figures of overcrowded mothers (Powers '08, pl. 24, figs. 20, 23, and 26). When, on the other hand, the number of cells in the daughter coenobia is the same as or less than the number in the mother there is ample room for the progeny in the posterior half or three-fifths of the mother.

The somatic cells of the adult coenobia were stated by Powers to range from 6 to 10 μ, most of them being of the smaller size. The distance separating them was given as usually 28 to 40 μ, though sometimes as great as 50 μ. The somatic cells in the daughters at the time of birth were stated to be about 5 μ, and Powers found that they increase to nearly or quite full size by the time the gonidia begin to divide.

In shape the somatic cells were stated to resemble most the figures which Meyer gave for his *Volvox tertius* (Powers '07, p. 139, Meyer '96, pl. 8, fig. Z), and like them they showed no signs of any connecting protoplasmic filaments between the neighboring protoplasts. From such observations as he made

on the cell membranes, Powers received the impression that these also resemble those of *V. tertius*.

A well-developed stigma in each of the somatic cells about the anterior pole of the coenobium was observed by Powers ('08, p. 150), and in the cells farther from that pole the stigmata were proportionately smaller, until a little back of the coenobial equator they were no longer visible as colored bodies. Powers was unable to decide whether at the posterior pole they were really quite absent, or whether one of a group of small colorless granules was the homologue of a pigment body. No recognizable stigma could be seen about the posterior pole even with an immersion lens. The stigmata about the anterior poles were visible in the daughters before birth.

Reproductive cells of one, two, or three kinds occur, according to Powers, in the same coenobium in numbers ranging from one to twenty-five, the numbers being about the same regardless of what kind or kinds were present. These reproductive cells are evidently differentiated at about the 256-celled stage of the development of the daughter coenobium. That such is the case appears from a comparison of the reproductive cells of a daughter coenobium with the cells of a sperm sphere found in the same mother (Powers '07, pl. 13, figs. 13 and 14). This sperm sphere consists of about 256 roundish cells, the maximum number for such a structure. The reproductive cells in the neighboring daughter coenobium are very similar in size and shape to these sperm-sphere cells, a fact which indicates that they were formed at the 256-celled stage and remained undivided while the somatogenic cells divided three times, producing about 1,800 somatic cells.

The number of reproductive cells in the daughter coenobia within four mother coenobia was determined by Powers ('07, p. 134) and they were found to occur with frequencies as given in Table 2.

TABLE 2.—*Distribution of reproductive cells in the daughters contained in four mother coenobia of Copelandosphaera spermatosphaera.*

Number of daughters.	Number of reproductive cells.									
	15	16	17	18	19	20	21	22	23	24
10	----	1	----	3	2	1	1	1	1	----
9	----	4	2	2	----	----	1	----	----	----
6	----	----	1	----	2	3	----	----	----	----
5	1	----	----	----	----	----	----	----	2	2

The highest number of reproductive cells found after a moderate search was twenty-five. In material consisting of coenobia averaging smaller in size than the first lot the average number of reproductive bodies is somewhat smaller, and Powers ('08, p. 145) reported a marked tendency for the coenobia to contain exactly eight oogonidia ("ova"), but the number was frequently increased to eleven or more.

The various combinations of reproductive bodies present in one hundred coenobia that were sufficiently mature for distinguishing between the different kinds, taken as they occurred in the preparations, were recorded by Powers with the results that are given in Table 3. Sperm spheres alone in mother coenobia, though not found among any of this hundred, were otherwise of not infrequent occurrence. The largest number of daughter coenobia observed in one mother was twenty-two. The largest number of oospores observed in one coenobium was reported as nineteen. The largest number of sperm spheres recorded was fourteen, and these were accompanied by two vegetative coenobia.

TABLE 3.—*Combinations of reproductive bodies in 100 matured coenobia of Copelandosphaera spermatosphaera.*

Number of mother coenobia.	Number of reproductive bodies.		
	Vegetative daughters.	Oospores.	Sperm spheres.
18	5–14	----------	----------
5	----------	7–16	----------
55	1–14	----------	1–11
12	2–13	1–7	1–8

The gonidia have, accordingly, at the time of differentiation diameters of about 9 μ (Powers '07, pl. 13, fig. 13), at the time of birth they measure about 15 to 18 μ ('07, p. 138), and at the time of segmentation, which is always considerably later than birth, they reach about 30 to 36 μ. Some rare cases illustrated by Powers ('07, pl. 13, fig. 18) of gonidia in which segmentation was delayed until they had reached a size of 51 μ are open to the suspicion of belonging to some other species. The segmentation of the gonidia was described as proceeding more slowly at first and then rapidly until the somatic cells are produced with diameters of about 3 μ, long before the young coenobia have closed to form complete spheres (Powers '07, p. 132). From this time on the somatic cells of the young coe-

nobia increase slowly in size throughout the entire period of growth.

The oogonidia, according to Powers, are reproductive cells like the gonidia, with which they may be mixed in the same coenobium. The highest number counted in coenobia which contained them alone was nineteen. They become larger than the gonidia, reaching 51 to 54 μ.

The oospores, according to Powers's photographs, develop a thick smooth wall within which the somewhat smaller protoplast is concentrically located.

The name androgonidia I will here apply to those reproductive cells which give rise to the sperm spheres. They occur mixed with the other reproductive cells in various proportions. They were described by Powers as about 1 to 3 μ smaller than the gonidia at the time of segmentation, and gave evidence of having cytoplasmic and nuclear structure different from that of the gonidia. They were found to segment more tardily than the gonidia to the extent that in their early stages the sperm spheres are one or two cell divisions behind the vegetative coenobia that develop from the gonidia.

The sperm spheres formed from the androgonidia, according to Powers, are *Eudorina*-like spheres of 32, 64, 128, or 256 cells, all of which proceed forthwith to divide and form sperm platelets, there being no somatic or vegetative cells among them. They have only rudimentary cilia and no power of locomotion. During the development of the sperm spheres the diameter of the constituent cells does not fall below 6 μ, whereas in the vegetative spheres the somatic cells become as small as 3 μ, though the reproductive cells appear to be about the size of the cells in the sperm spheres. The form of the sperm spheres, as before stated, was described as spherical, except when they were deformed by pressure.

A sperm platelet consisting usually of thirty-two spermatozoids though sometimes of sixty-four, is formed from each cell of the sperm sphere, the number of sperms being the same in all the platelets of a sphere. The sperm sphere with its platelets is functionally a compound antheridium and may be conveniently so styled.

The spermatozoids were described by Powers as compact, with spherical nuclei and terminal cilia ('07, p. 134).

DIAGNOSES OF GENUS AND SPECIES

Genus COPELANDOSPHAERA novum

(*Volvocaceae, Volvoceae*)

Body a spherical or ellipsoidal coenobium of biciliate cells that contain chloroplasts. The cells appear to lie in the periphery of a gelatinous matrix surrounded by a hyaline envelope through which the cilia protrude. Somatic protoplasts globose or ovoid, each inclosed in a thick gelatinous membrane that is more or less prismatic in form. No protoplasmic filaments connecting the protoplasts. Asexual reproduction by gonidia that are differentiated in late embryonic stages of the coenobia producing them. The gonidia develop to relatively moderate size before segmentation. Oogonidia and androgonidia in the same coenobia with gonidia or in sexual coenobia. Antheridia consisting of sperm platelets or of sperm spheres compounded of sperm platelets. Spermatozoids with terminal cilia.

The type species of this genus is the new species *Copelandosphaera dissipatrix,* described herewith from the Philippine Islands. One other species takes a place in this genus; namely, *Volvox spermatosphara* Powers, which was described from western North America. The diagnosis of that species given herewith is a revision of Powers's original definition and is made in accord with the details of his description and figures.

COPELANDOSPHAERA DISSIPATRIX sp. nov. Plates 1 to 4.

Coenobia spherical or ellipsoidal; asexual 1,000 μ, more or less (2,250 μ recorded), about 300 by 350 μ at birth; sexual 620 by 660 μ, more or less (973 recorded). Number of cells usually between 9,000 and 25,000 (52,600 recorded). Protoplasts globose to ellipsoidal, about 4 by 5 μ to 5 by 6 μ in diameter; about 3 μ wide at time of birth; spaced 8 to 20 μ apart (center to center). Stigmata large in cells about the anterior pole, gradually decreasing in size backward. Reproductive cells confined to the posterior half, three-fifths, or three-fourths of the coenobia. Gonidia in asexual coenobia; 4 to 15; not arranged in pairs or fours; differentiated at about the stage before the last two or three growth divisions; reaching about 20 to 22 μ and segmenting to produce embryos that are 8- to 16-celled by the time of birth or segmenting after birth. Early stages of embryos globose; later embryonic stages oblate; daughters becoming prolate before birth. Oogonidia and andro-

gonidia in the same sexual coenobia. Oogonidia mostly between 50 and 150; smaller and appearing later than the gonidia, in sister coenobia; differentiated at about the time of the growth divisions; about 18 μ at time of birth; reaching about 46 μ. Oospores with smooth or slightly wavy walls. Androgonidia few; about the same size as the oogonidia and scattered among them; each forming a sperm platelet of 256 sperms. Spermatozoids probably with terminal cilia.

Habitat.—Fresh-water pools near Manila, Philippine Islands (*leg.* W. R. Shaw, 1914).

COPELANDOSPHAERA SPERMATOSPHAERA (Powers) comb. nov.

"First form of Volvox," Powers in Trans. Am. Microscop. Soc. 27 (1907) 124–140, 146–148, pls. 11–13, figs. 1–17.

Volvox spermatosphara Powers in Trans. Am. Microscop. Soc. 28 (1908) 142–151, 171–172, pls. 23 and 24, figs. 1–23 and 26.

Volvox spermatosphaera (Powers) West in Journ. Quekett Mic. Club II 11 (1910) 101.

Coenobia spherical or ellipsoidal; 150 to 1,000 μ (more commonly 250 to 600 μ) at maturity; about 250 μ or less at time of birth. Somatic cells about 1,000 to 3,000; protoplasts globose to ovoid; 6 to 10 μ in diameter (mostly nearer the smaller size); about 5 μ at time of birth; spaced in adults 28 to 40 or even 50 μ apart. Stigmata large in the cells about the anterior pole, gradually decreasing in size backward, and becoming invisible not far back of the coenobial equator. Reproductive cells 1 to 25, whether gonidia, oogonidia, androgonidia, or mixtures of two or three kinds in the same coenobium; confined to posterior half or three-fifths of the coenobium; differentiated from somatogenic cells at about the 256-celled stage; about 15 to 18 μ at time of birth. The gonidia segment after birth, when they reach about 30 to 36 μ, and produce vegetative coenobia. The oogonia mature at about 51 to 54 μ. Oospores with a smooth wall around a concentrically placed zygote. Androgonidia 1 to 3 μ smaller than the gonidia, and of different constitution; segmenting more tardily; each producing a hollow sphere of 32 to 256 weakly ciliated cells that segment forthwith and produce each a platelet of 32 or, sometimes, 64 sperms. The resulting compound antheridia or "sperm spheres" measure about 80 to 180 μ, have no power of locomotion, and usually mature after fecundation of the eggs in the same coenobium. Spermatozoids compact, with spherical nuclei and terminal cilia.

Habitat.—The shallow remnant of a prairie pond containing considerable alkali, Nebraska (J. H. Powers, 1903?); shallow

bodies of water, Nebraska (J. H. Powers, 1904?); Washington State (Elda R. Walker, 1904?); a shallow pond, near Rocheport, Missouri (R. H. Wolcott, 1904); and probably New Orleans, Louisiana (E. Foster, 1904?).

THE RELATIONSHIPS OF COPELANDOSPHAERA

It has been pointed out by Crow ('18) that *Stephanosphaera* and *Volvox* bear, in the characters of their cell membranes, cell connections, contractile vacuoles, and chloroplasts, a strong resemblance to the unicellular genus *Sphaerella*, whereas the other multicellular genera of the Volvocaceae resemble in these characters the unicellular genus *Chlamydomonas*. According to Crow, the relationships of these genera would be best expressed by grouping them into two families, the Sphaerellaceae and the Chlamydomonadaceae, that present two lines of evolution on parallel lines. Such an arrangement would bring into the Chlamydomonadaceae in this sense *Gonium*, *Pandorina*, *Stephanoon*, and *Eudorina* of lower organization, *Pleodorina* and *Besseyosphaera* of intermediate organization, and *Copelandosphaera*, *Merrillosphaera*, and *Campbellosphaera* of higher organization. While such a disposition may represent the course of phylogeny, nevertheless the subfamily Volvoceae, embracing all the multicellular Volvocaceae, will be useful for practical purposes.

A key to the genera and species of Volvoceae, which is herewith presented, will serve to show the position of *Copelandosphaera* among its relatives.

The nearest relative to *Copelandosphaera* on the side of lower organization is *Besseyosphaera*, which has its gonidia not differentiated until after the birth of the coenobia. Although the sexual reproduction of the latter genus is not known, we can, without difficulty, picture it as something intermediate between that of *Copelandosphaera* and that of *Pleodorina californica* as described by Chatton ('11), and not greatly different from either.

The nearest relatives on the side of higher organization are the species of *Merrillosphaera*. The relationship is so close that some people may prefer to reduce them all to one genus. This would be undesirable at the present time, for it is almost certainly true that the assumption that all of *Volvox* is comprised in two or at most three species was, until the time of Powers's work, a deterrent to the proper study of such forms of this group as were found. In identifying them, if the form in hand had rounded protoplasts it was set down as *Volvox aureus*, and if no protoplasmic connections could be seen it was

assumed that they were probaly too fine to be visible with the magnification used or with the fixing and mounting media employed. Until the Volvocaceae have been studied in all quarters

FIG. 2. The phylogeny of the Volvoceae. All the genera above the horizontal line are of this subfamily except *Stephanosphaera* and *Spondylomorum*. The latter are sometimes so treated for convenience. The genera below the horizontal line are unicellular.

of the globe it will be conducive to more discriminating investigation of the members of the group if the species remain segregated in their several genera. Subgenera are not equally

adapted to this end. There is reason to believe that, as was pointed out by Powers ('08 p. 170), European workers have encountered in their own region species that have not received due recognition until found elsewhere.

My present view, in December, 1921, of the relationships of *Copelandosphaera* is indicated by the diagram of the phylogeny of the Volvoceae given in fig. 2. The broken line from *Stephanosphaera* to *Volvox* is a reminder of the view advanced by Crow ('18) that *Volvox* and *Janetosphaera* are allied to *Sphaerella* rather than to *Chlamydomonas*. According to his view the species shown here should be represented as forming two genetic trees instead of one.

KEYS TO THE GENERA AND SPECIES OF THE SUBFAMILY VOLVOCEAE

Key to the genera.

1. Coenobium a plate of biciliate cells.
   2. Cells all facing with one side of plate..... **Gonium.**
   2. Some cells facing with each side of plate..... **Platydorina.**
1. Coenobium globose, ellipsoidal or ovoid.
   2. Cells on equatorial belt, facing outward..... **Stephanoon.**
   2. Cells in entire surface of spheroid.
      3. Cells all alike.
         4. Inner sides of cells pyramidal..... **Pandorina.**
         4. Cells globose ..... **Eudorina.**
      3. Vegetative cells differentiated.
         4. No vegetative cells in reproductive area..... **Pleodorina.**
         4. Vegetative cells in reproductive area.
            5. Gonidia differentiated after birth..... **Besseyosphaera.**
            5. Gonidia differentiated before birth.
               6. No intercellular protoplasmic strands.
                  7. Gonidia not differentiated in young embryos. **Copelandosphaera.**
                  7. Gonidia differentiated in young embryos; becoming very large.
                     8. Gonidia not migratory in embryos..... **Merrillosphaera.**
                     8. Gonidia migratory in embryos..... **Campbellosphaera.**
               6. Cells connected by intercellular protoplasmic strands.
                  7. Cells round; without separate inner walls.... **Janetosphaera.**
                  7. Cells stellate; with separate inner walls..... **Volvox.**

Key to the species.

GONIUM

1. Cells 16..... **G. pectorale Müll.**
1. Cells 4.
   2. Cilia vibratile throughout..... **G. sociale (Duj.) Warm.**
   2. Cilia vibratile only in terminal half..... **G. lacustre West.**

PLATYDORINA

Cells 16 or 32, arranged in a horseshoe-shaped plate, those of the two faces intercalated; posterior end with 3 or 5 tails..... **P. caudata Kofoid.**

STEPHANOON

Cells 16, in two alternating rows on the equator..... **S. askenasii** Schewk.

PANDORINA

Cells 16 or 32, crowded, each with a single chromatophore and pyrenoid. **P. morum** Bory.

EUDORINA

Cells 16, 32, or 64..... **E. elegans** Ehrenb.

PLEODORINA

Cells 32, rarely 16 or 64; gonidia not more than twice the diameter of the vegetative cells which constitute the anterior quartet. **P. illinoisensis** Kofoid.

Cells nearly 128, rarely 64, 32, or fewer; gonidia about two to three times the diameter of the vegetative cells; vegetative cells constituting the greater part of the anterior hemisphere..... **P. californica** Shaw.

BESSEYOSPHAERA

Cells about 1,000; gonidia 10 to 78, distributed in two-thirds to four-fifths of the coenobium, developed in daughters after birth. **B. powersi** (Powers) Shaw.

COPELANDOSPHAERA

Cells 9,000 to 25,000 or more; gonidia 4 to 15; sperm platelets in monoecious coenobia ..... **C. dissipatrix sp. nov.**

Cells 1,000 to 3,000; gonidia 1 to 25; sperm platelets in sperm spheres. **C. spermatosphaera** (Powers) **comb. nov.**

MERRILLOSPHAERA

1. Coenobia strongly ovoid; gonidia in pairs; those of the posterior pair the smaller..... **M. africana** (West) Shaw.
1. Coenobia subglobose or ellipsoidal; gonidia mostly about equal and in fours.
   2. Gonidia and oogonidia in separate coenobia.... **M. carteri** (Stein) Shaw.
   2. Gonidia and oogonidia in the same coenobia.
      3. Oospores of about the same number as the gonidia. **M. migulae** Shaw.
      3. Oospores more numerous than gonidia..... **M. tertia** (Meyer) Shaw.

CAMPBELLOSPHAERA

Gonidia 8 or less; anterior gonidia usually the smaller when not all are alike..... **C. obversa** Shaw.

JANETOSPHAERA

Oospores with eccentric double walls..... **J. aureus** (Ehrenb.) Shaw.

VOLVOX

1. Oospore walls angularly wavy..... **V. globator** (L.) Ehrenb.
1. Oospore walls crenate..... **V. perglobator** Powers.
1. Oospore walls spinose.
   2. Sexual coenobia dioecious..... **V. rousseleti** West.
   2. Sexual coenobia monoecious.
      3. Somatic protoplasts large and broad..... **V. merrilli** Shaw.
      3. Somatic protoplasts small and narrow..... **V. barberi** Shaw.

LITERATURE CITED

CARTER, H. J. ('59). On fecundation in the two Volvoces, and their specific differences. Ann. & Mag. Nat. Hist. III 3 (1859) 1–20, pl. 1.

CHATTON, E. ('11). Pleodorina californica a Banyuls-sur-mer. Son cycle évolutif et sa signification phylogénique. Bull. Sci. France et Belg. VII 44 (1911) 309–331, pl. 7.

COHN, F. ('75). Die Entwickelungsgeschichte der Gattung Volvox. Festschr. z. Göpperts 50 jährig. Doktorjubiläum. Breslau (1875) 34 pp., 1 col. pl.

CROW, W. B. ('18). The classification of some colonial chlamydomonads. New Phytologist 17 (1918) 151–159.

EHRENBERG, C. G. ('38). Die Infusionsthiere als vollkommene Organismen. Berlin and Leipzig (1838). (Not seen.)

JANET, C. ('12). Le Volvox. Limoges (1912) 151 pp.

JANET, C. ('14). Note préliminaire sur l'oeuf du Volvox globator. Limoges (1914) 12 pp.

KLEIN, L. ('89A). Morphologische und biologische Studien über die Gattung Volvox. Jahrb. wiss. Bot. 20 (1889) 133–211, pls. 10–12.

KLEIN, L. ('89B). Neue Beiträge zur Kenntniss der Gattung Volvox. Ber. deutschen bot. Ges. 7 (1889) 42–53, pl. 3.

KLEIN, L. ('90). Vergl. Untersuchungen über Morphologie und Biologie der Fortpflanzung bei der Gattung Volvox. Ber. naturf. Ges. Freiburg i. B. 5 (1890) 92 pp., pls. 2–6.

KOFOID, C. A. ('98). On Pleodorina illinoisensis, a new species from the plankton of the Illinois River. Bull. Ill. State Lab. Nat. Hist. 5 (1898) 273–293, pls. 36, 37.

KOFOID, C. A. ('99). On Platydorina, a new genus of the family Volvocidae, from the plankton of the Illinois River. Bull. Ill. State Lab. Nat. Hist. 5 (1899) 419–440, pl. 38.

MERTON, H. ('08). Ueber den Bau und die Fortpflanzung von Pleodorina illinoisensis Kofoid. Zeitschr. wiss. Zool. 90 (1908) 445–477, pls. 27, 28, 1 col.

MEYER, A. ('95). Ueber den Bau von Volvox aureus Ehrenb. und Volvox globator Ehrenb. Bot. Centralbl. 63 (1895).

MEYER, A. ('96). Die Plasmaverbindung und die Membranen von Volvox, mit Rücksicht auf die thierischen Zellen. Bot. Zeit. 54 [1] (1896) 187–217, pl. 8.

OVERTON, E. ('89). Beitrag zur Kenntniss der Gattung Volvox. Bot. Centralbl. 39 (1889) 39 pp., 4 pls.

POWERS, J. H. ('07). New forms of Volvox. Trans. Am. Microscop. Soc. 27 (1907) 123–149, pls. 11–14.

POWERS, J. H. ('08). Further studies in Volvox, with descriptions of three new species. Trans. Am. Microscop. Soc. 28 (1908) 141–175, pls. 23–26.

SHAW, W. R. ('94). Pleodorina, a new genus of the Volvocineae. Bot. Gaz. 19 (1894) 279–283, pl. 27.

SHAW, W. R. ('16). Besseyosphaera, a new genus of the Volvocaceae. Bot. Gaz. 61 (1916) 253, 254.

SHAW, W. R. ('18). Some microtechnical methods and devices. Philip. Journ. Sci. Bot. 13 (1918) 241–261.

SHAW, W. R. ('19). Campbellosphaera, a new genus of the Volvocaceae. Philip. Journ. Sci. 15 (1919) 493–520, 2 pls.

SHAW, W. R. ('22A). Janetosphaera, a new genus, and two new species of Volvox. Philip. Journ. Sci. 20 (1922) 477–508, 5 pls., 5 text figs.

SHAW, W. R. ('22B). Merrillosphaera, a new genus of the Volvocaceae. Philip. Journ. Sci. 21 (1922) 87–129, 8 pls., 1 text fig.

STEIN, F. ('78). Der Organismus der Infusionsthiere. Leipzig 3 [1] (1878) 134.

WEST, G. S. ('10). Some new African species of Volvox. Journ. Quekett Micr. Club II 11 (1910) 99–104, pl. 3.

WEST, G. S. ('16). Algae. Cambridge 1 (1916) 181.

WEST, G. S. ('18). A further contribution to our knowledge of the two African species of Volvox. Journ. Quekett Micr. Club II 13 (1918) 425–428, pls. 29–30.

ILLUSTRATIONS

[Photomicrographs of *Copelandosphaera dissipatrix* sp. nov. from specimens mounted in glycerine and Venetian turpentine, taken by W. R. Shaw and E. Cortes at the Bureau of Science, Manila.]

PLATE 1

FIG. 1. Sexual coenobium, mounted in glycerine, containing about one hundred twenty-seven oogonidia and seven antheridia. Four of the antheridia appear in the photograph, two presenting a surface view and two an edge view. × 100.

2. A portion of the same specimen showing the two antheridia that present a surface view and four of the oogonidia. Most of the somatic cells are out of focus in the photograph, though some near the ends of the figure, along the line between the dark and light protoplasts, are in focus. × about 200.

3. A portion of the same specimen on a larger scale. The scale at the right is a part of a stage micrometer scale with smallest divisions of 10 μ that was photographed on the same plate and with the same adjustment of apparatus that was used for the specimen. × about 405.

PLATE 2

FIG. 4. A nearly mature sexual coenobium in glycerine. The oogonidia on the lower side are more nearly in focus than those on the upper side. Number of oogonidia counted, 130. × 50.

5. A nearly mature sexual coenobium in glycerine. Number of oogonidia counted, 112. × 50.

6. An asexual coenobium, the type specimen, in Venetian turpentine. This is shown on a larger scale in Plate 3, fig. 13. × 50.

7. An asexual coenobium in glycerine. It has four daughters in about the 1,024-celled stage. × 50.

8. An asexual coenobium in glycerine. It has fifteen embryonic daughters in about the 64-celled stage. The photograph shows the open phialopores of those embryos that face them toward the observer. × 100.

9. An asexual coenobium in Venetian turpentine. It has ten daughter coenobia. Of these eight contain gonidia and in two no reproductive cells are yet differentiated. These are probably sexual daughters. × 100.

10. An asexual coenobium in glycerine. It has eight embryonic daughters that are in the 256- or 512-celled stage. × 50.

PLATE 3

FIG. 11. An asexual coenobium in glycerine. It contains ten embryonic daughters. × 100.

12. Part of a sexual coenobium in Venetian turpentine. It shows some immature oospores and some flask-shaped unicellular algae that are embedded in the membranes of the somatic cells. × 400.

13. The type specimen of *Copelandosphaera dissipatrix* in Venetian turpentine. It contains nine daughters which in turn contain gonidia or embryos of two or four cells. A number of flask-shaped unicellular algae are embedded in the membranes of the somatic layer. × 100.

PLATE 4

FIG. 14. An asexual coenobium with ten daughters, in glycerine. × 100.
15. A sexual coenobium in Venetian turpentine, very much shrunken, of which a part is shown in Plate 3, fig. 12. It contains eighty-one reproductive bodies. Of these seventy-one have begun to develop spore walls. × 100.
16. An asexual coenobium with six daughters, in glycerine. × 100.

TEXT FIGURES

FIG. 1. Optical section through mother and daughter coenobia of the type specimen, in Venetian turpentine.
2. The phylogeny of the Volvoceae.

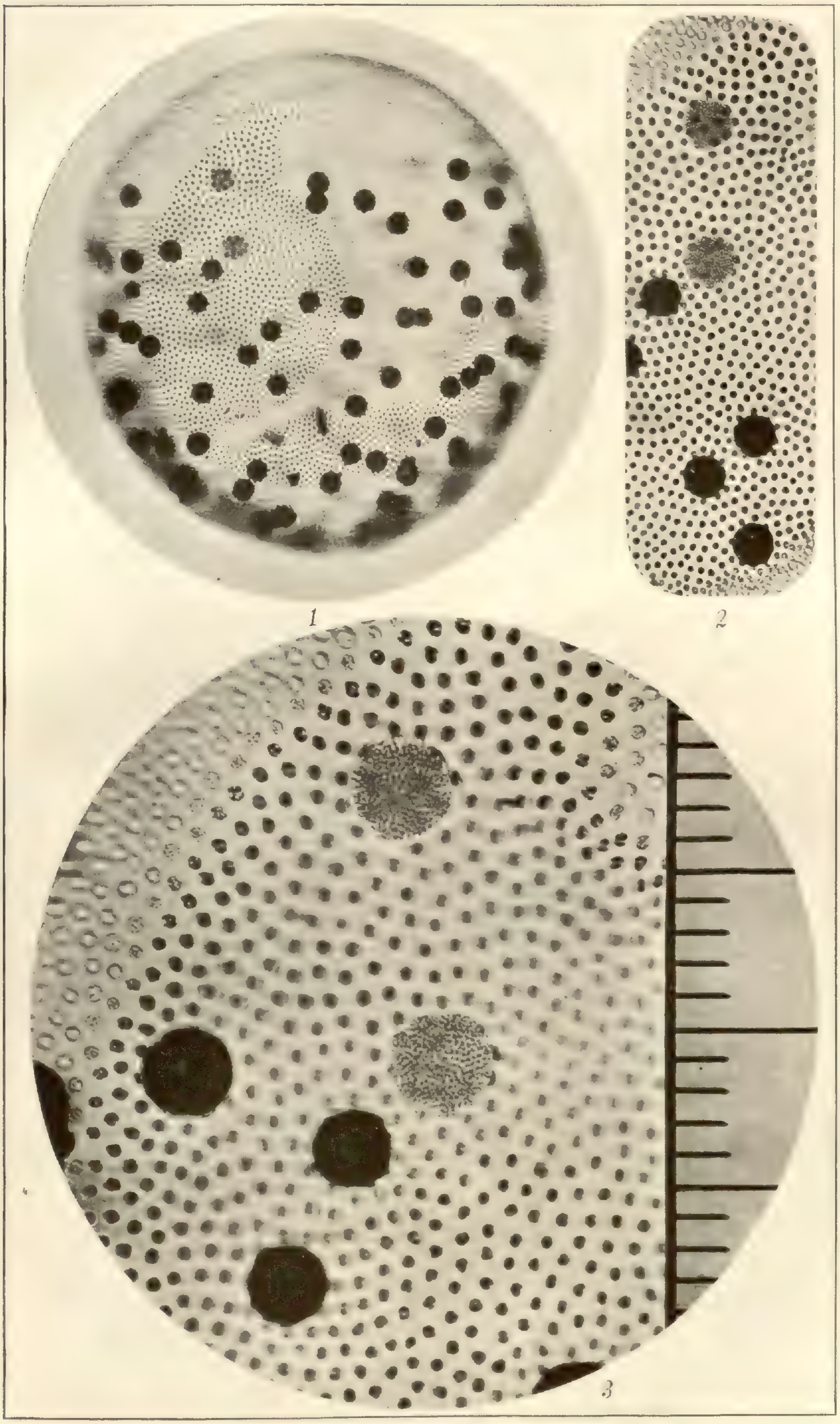

PLATE 1. COPELANDOSPHAERA DISSIPATRIX SP. NOV.

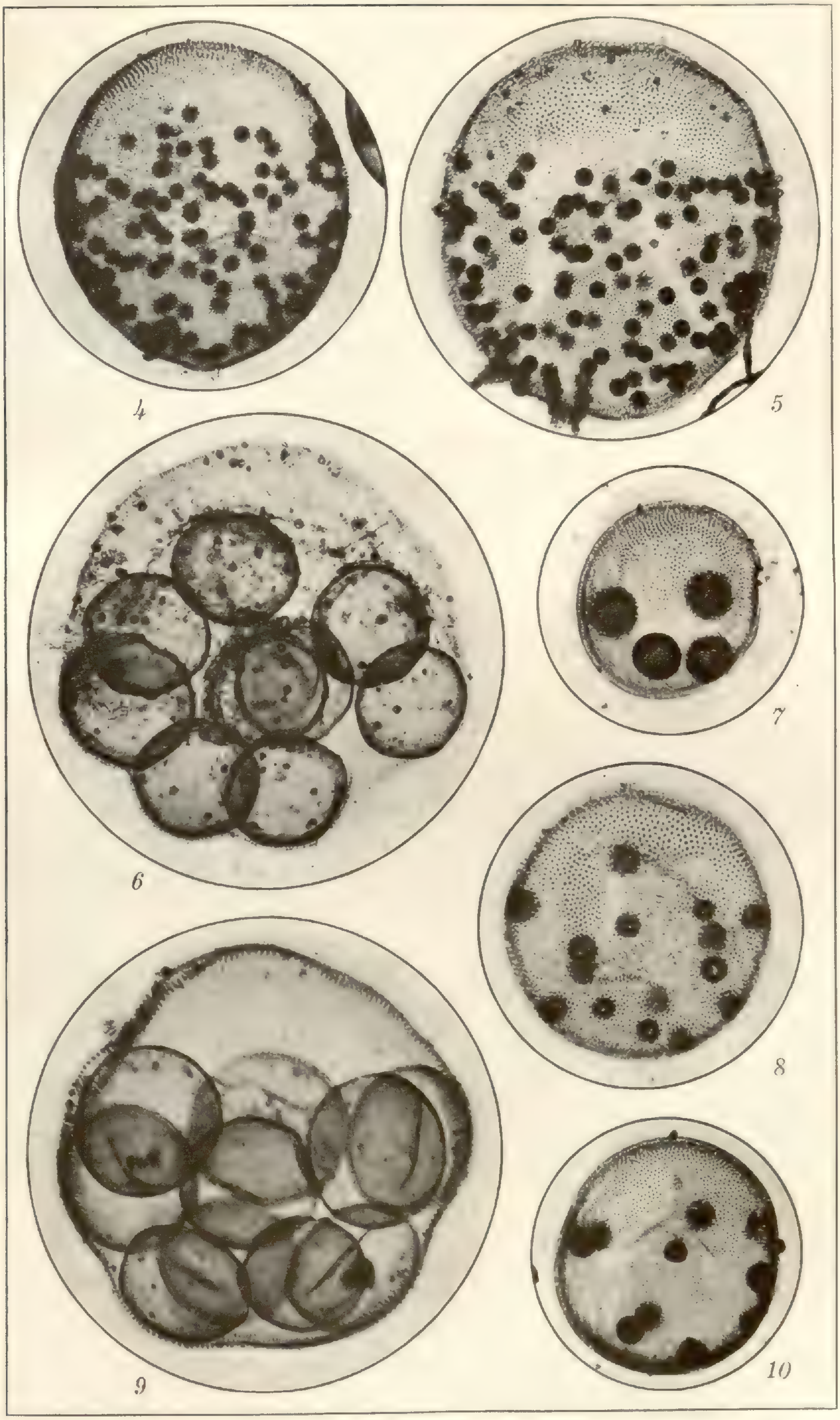

PLATE 2. COPELANDOSPHAERA DISSIPATRIX SP. NOV.

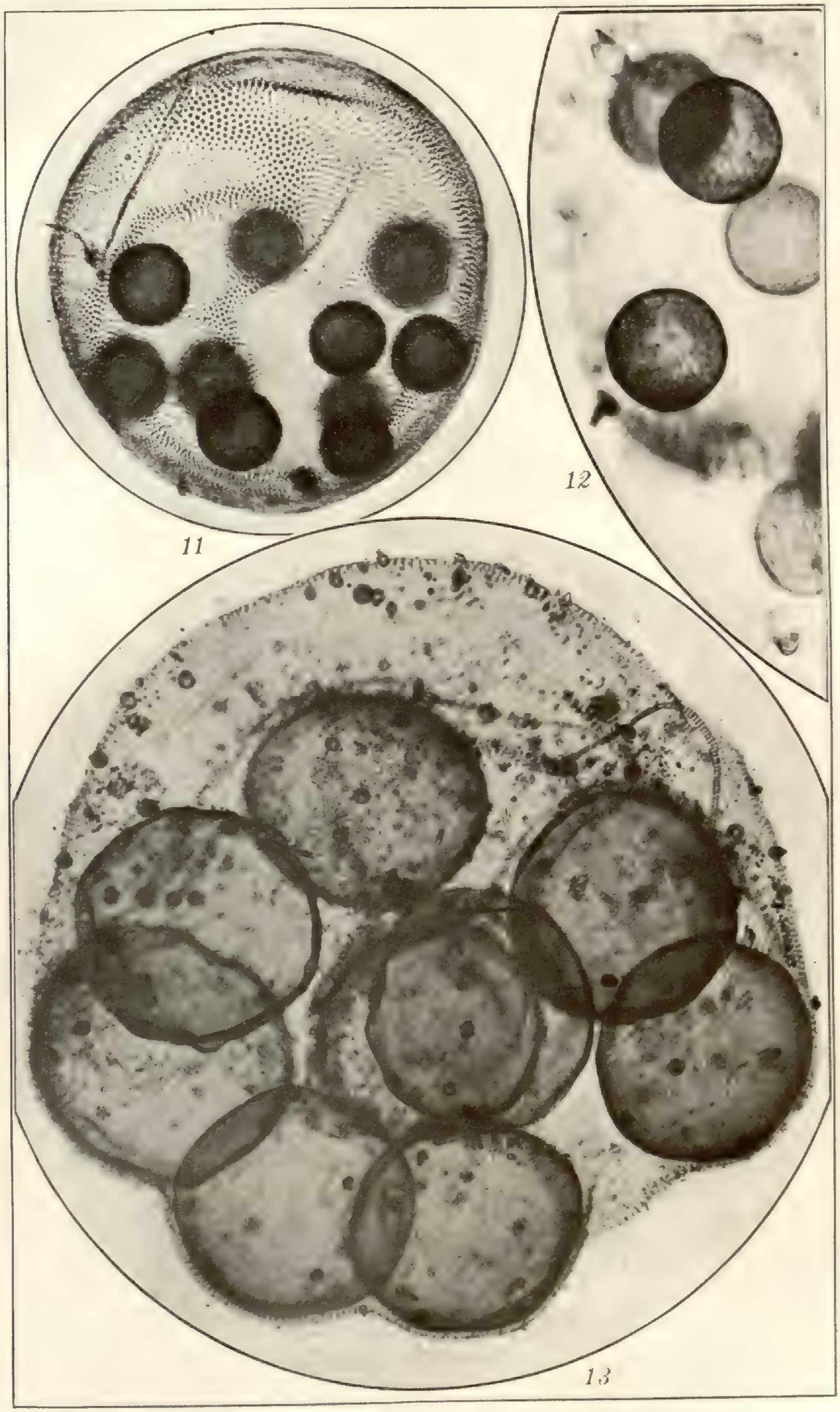

PLATE 3. COPELANDOSPHAERA DISSIPATRIX SP. NOV.

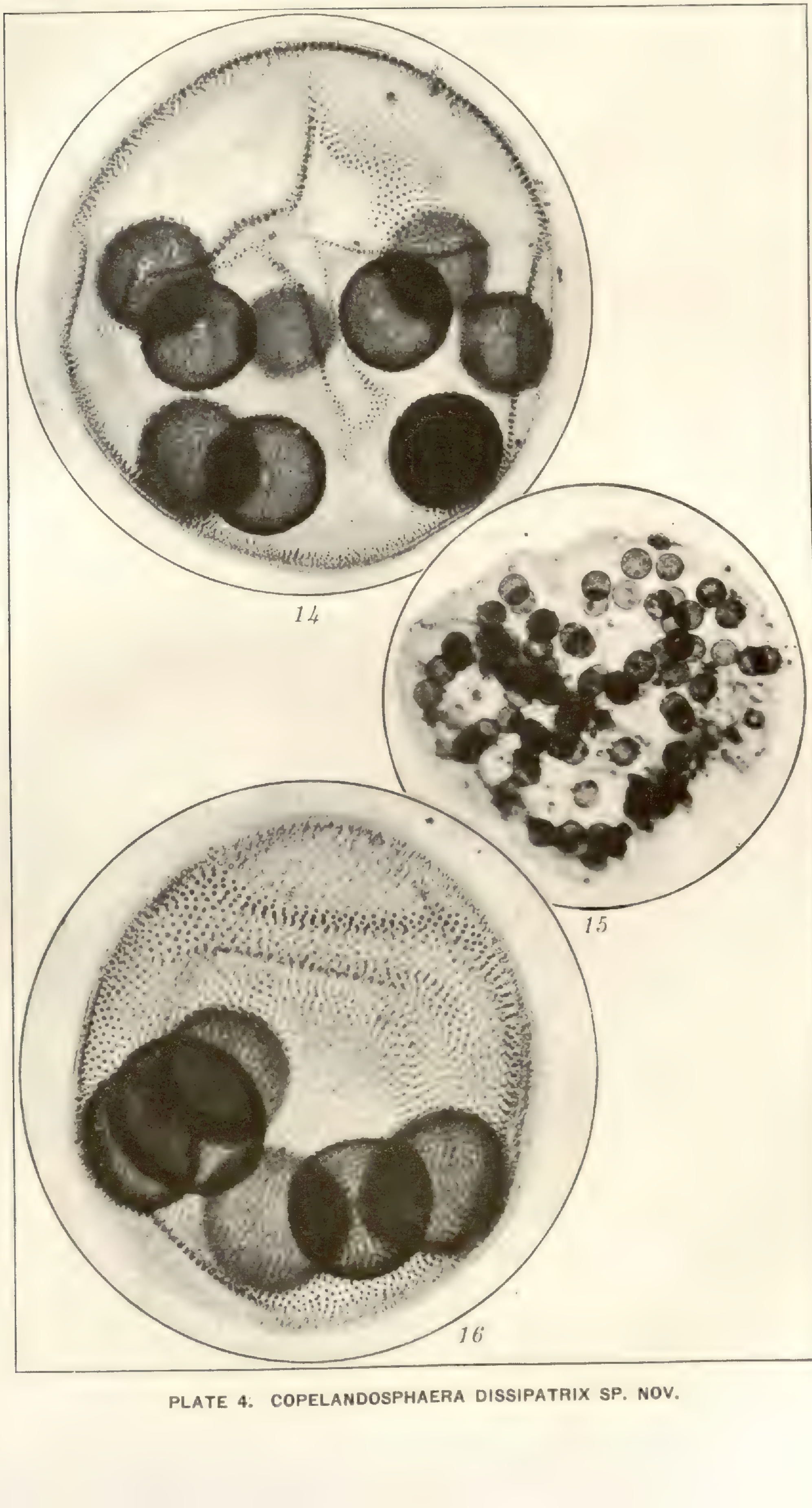

PLATE 4. COPELANDOSPHAERA DISSIPATRIX SP. NOV.

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EARLY LESIONS AND THE DEVELOPMENT AND INCIDENCE OF LEPROSY IN THE CHILDREN OF LEPERS

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SIX PLATES

Since 1906 the lepers in the Philippine Islands have been segregated on Culion Island with the view to reducing and finally exterminating leprosy. Thus, a colony for lepers has been established which at present contains a population of about five thousand.

At the beginning of the establishment of the colony children conceived outside were born there; since then, on account of inter-marriage among lepers, the number of births in the leper colony has been steadily increasing. In 1916 a limited number of healthy children were isolated in a separate building known as the "Negative Children's House," located away from the leper population. Also, a small number were sent away from Culion Island and adopted by relatives or other persons who guaranteed their ability to take care of them. However, on account of the inadequate facilities for isolation, the immense majority of the children born of leper parents were permitted to live with them and among other lepers.

There were born in the colony, since 1906 to December 31, 1921, inclusive, 689 children. Of this number 333 died and 51

were sent away from Culion, 3 of whom were returned later to the colony. There were residing at the end of 1921, 308 children born in the colony (both parents of practically all of them being lepers) the majority of whom were living among lepers; a limited number were isolated in the Negative Children's House after having been in intimate contact with lepers for varying lengths of time.

The children now living in the Culion Leper Colony, born of leper parents and raised among lepers—that is, in an ideal environment for infection—offer favorable material for the study of the early lesions and the development of leprosy. This paper is the result of the study of the records in the colony, and repeated clinical and bacteriological examinations made during the period between June, 1921, and March, 1922, of all children born up to December 31, 1921, inclusive, and now residing in the colony.

MORBIDITY AND MORTALITY

As a rule the healthy children of lepers show the same physical and mental development as do the children of healthy parents.

No records were kept in the colony of minor ailments among the children, but the general observation is that they are subject to the diseases of childhood that occur among children of the same age in healthy communities, and that they are not particularly susceptible to any childhood disease.

On examination of the children we were struck by the frequency of diseases of the skin other than leprosy. Over one-third of the number examined showed active or recent lesions of an itch of some kind, which in many cases persists for years and becomes generalized all over the body and is eczematous in nature. There are also a few others suffering from tinea, yaws, and other skin diseases.

No comparison can be made with the incidence and nature of skin diseases in nonleper communities, as no data are available; but it seems that the "itch" among the children of lepers is rather rebellious to treatment.

The mortality among children of lepers during the first years of the establishment of the colony was very high; none of the children born in 1906 and 1907 survived. The mortality steadily decreased in subsequent years on account of better care and accommodation of the population. In the City of Manila from 1905 to 1918, inclusive, deaths among children under 1 year of age averaged 41.3 per cent of the total number of births (stillbirths excluded).(6) In the Culion Leper Colony, up to De-

cember 31, 1921, there were 290 deaths, or 42 per cent, among children under 1 year of age out of a total of 689 births, excluding stillbirths. This is practically the same percentage of infantile deaths as occurs in a nonleper population.

Table 1 gives an idea of the ages and the causes of death of children of lepers born in the colony. These data have been gathered from the colony records; the diagnoses cannot be considered as very accurate, as no autopsies of such children were made.

TABLE 1.—*Causes of death among children born of leper parents in the colony, by age groups and by causes of death, from May, 1906, to December 31, 1921, inclusive.*

Cause of death.	Age groups, years.			Total.
	0-1	1-2	2 +	
Asphyxia neonatorum	1			1
Beriberi	16	2		18
Bronchitis, acute	14	1		15
Bronchopneumonia	10	1		11
Congenital debility (including athrepsia, malnutrition, and marasmus)	95	4	1	100
Diarrhœa and enteritis	3			3
Diphtheria			1	1
Dysentery, bacillary	10	6	2	18
Gastritis	10			10
Gastroenteritis, acute	31	4	1	36
Gastroenteritis, chronic	6	3		9
Infantile convulsions	49			49
Influenza	3	4		7
Ill defined	24			24
Malaria	1	2	2	5
Meningitis	4	1	2	7
Nephritis	5	2	2	9
Pneumonia	3			3
Prematurity	3			3
Umbilical tetanus	2			2
Tonsillitis		1		1
Varioloid			1	1
Total	290	31	12	333

On examining Table 1 it will be noticed that infantile debility (including malnutrition, athrepsia, and marasmus) holds the first place among the causes of death; then follow the gastro-intestinal disturbances and infantile convulsions. According to the annual reports of the Director of Health of the Philippine Islands, during the period from 1904 to 1920, there were, in the City of Manila, 8,451 deaths, or 14.6 per cent, from congenital debility out of a total of 57,782 deaths from all diseases of

children under 1 year of age. According to Table 1 there were 100 deaths, or 34 per cent, due to infantile debility out of a total of 290 deaths from all causes in children under 1 year of age. Therefore, the proportion of deaths from infantile debility is relatively higher than in nonleper communities, which may be presumed to be due to the weakened condition of the parents.

The increase in deaths from infantile debility is partly compensated by the small number of deaths from infantile beriberi, which is one of the important causes of infant mortality in nonleper populations. This is due to the use of unpolished rice in the diet in the colony.

THE SITE OF THE EARLY LESION

Our data regarding the site of the initial lesion of leprosy are based on comparison of the physical and bacteriological examinations of the skin and nose. Bacteriological examination was made of the skin of all children showing suspicious or characteristic lesions, and in practically all of these the secretion and scrapings from the nose have also been examined. Dr. Felisa Nicolas, of the eye, ear, nose, and throat department of the Philippine General Hospital, on a visit to Culion, kindly made inspection of the noses of twenty-six children who either were nonlepers or showed suspicious or definite lesions of leprosy in the skin. The findings of Doctor Nicolas, compared with results of the physical and bacteriological examinations of the skin lesions and the nose, are shown in Table 2.

The physical examination of the skin comprised, besides inspection, the testing for tactile and thermal anæsthesia and the determination of areas of anhidrosis by the injection of pilocarpine solution. Tactile anæsthesia was tested by the light application of the point of a pin and asking the child to point out the location where the pin was applied. Thermal anæsthesia was tested by applying alternately hot water and cold water in test tubes; this test was applied to older children who could give intelligent answers. To test the anhidrosis a solution of 1 milligram of pilocarpine nitrate to 1 cubic centimeter of water was prepared, and subcutaneous injection was made of an amount that was proportionate to the age of the child as figured by the formula of Young,[1] on the basis of 5 milligrams as the average dose for the adult; and, in addition to the pilocarpine, hot tea was given to drink, and the child wrapped in a

[1] $\frac{12 + \text{age}}{\text{age}}$ = the denominator of a fraction the numerator of which is 1.

blanket and examined after the breaking out of copious sweat. The sensibility to pain was not tested because, except in extreme cases, it is hard to determine from the answers of the children the dissociation of the tactile and the pain sensations.

The physical examination of the nose was made with the aid of a nasal speculum, in ordinary daylight, which naturally did not show the hind portions of the nasal cavity.

The specimen for bacteriological examination was obtained by scraping about the edge of the suspicious lesion in the skin; or, in the case of the nose, by scraping the suspicious lesion noticed on the physical inspection; or, in the absence of such lesion, the specimen was obtained from the site at about the junction of the cartilaginous and bony portions of the septum. The scraping was made with a sharp knife until a small amount of serum and blood was obtained; this material was smeared over a glass slide, fixed by heat, stained by steaming carbol-fuchsin, washed in water, and decolorized with Gabbett's methylene blue.

TABLE 2.—*Results of physical and bacteriological examinations of the skin and nose of children of lepers, November, 1921.*

No.	Initials.	Age.	Examination of skin.		Examination of nose.		Diagnosis, type of leprosy.
			Physical.	Bacteriological.	Physical.	Bacteriological.	
		Yrs.					
1	F.T.	10	Negative	—	Negative	—	Nonleper.
2	S.P.	7	Negative; no scabies	—	Erosion of mucosa, anterior portion septum, both sides.	—	Do.
3	B.M.	6	Negative	—	Right side negative; small ulcer septum, left side, anterior margin of quadrilateral cartilage.	—	Do.
4	A.C.	2	do	—	Slight erosion, mucosa, both sides of septum.	—	Do.
5	A.N.	8	White area on right side; scabies; no pilocarpine test made.	—	Shallow ulcer, right side, anterior portion of septum; left side negative.	—	Suspicious.
6	L. de la C.	8	White particles on face and neck and chin, which are not anæsthetic and show sweating on pilocarpine injection.	—	Left side apparently negative; small nodule right side septum, anterior margin quadrilateral cartilage.	—	Do.

TABLE 2.—*Results of physical and bacteriological examinations of the skin and nose of children of lepers, November, 1921*—Continued.

No.	Initials.	Age.	Examination of skin.		Examination of nose.		Diagnosis, type of leprosy.
			Physical.	Bacteriological.	Physical.	Bacteriological.	
		Yrs.					
7	V. C..	8	White area on right loin; no anæsthesia and no anhidrosis.	—	Negative, both sides.	—	Suspicious.
8	A.V.S.	8	White spot over right loin showing center, which does not sweat on pilocarpine test.	—	.....do.....	—	Macular.
9	A. F..	7	Whitish, nonanæsthetic areas which do not sweat on face, left buttock, and right thigh.	—	Left side negative; ulcer right side of septum, anterior portion.	—	Do.
10	L. T...	8	Whitish, anhidrotic area on left loin; apparently flushed face like sunburn, but no anæsthesia.	—	Ulcer both sides of septum, anterior portion.	—	Do.
11	M. de L...	6	White area above right knee; primary yaws; pilocarpine test unsatisfactory.	—	Negative	—	Do.
12	G. D..	5	White anhidrotic spots all over the body, which show no tactile anæsthesia.	—	Negative, both sides	—	Do.
13	F. A..	2	Small whitish areas all over body with reddish centers, especially on limbs; no anæsthesia and no anhidrosis.		.....do.....	—	Do.
14	M. Z..	12	Whitish, anæsthetic, anhidrotic area on back of left thigh.	—	.....do.....		Maculo-anæsthetic.
15	M. C..	8	Diffuse reddish area from nates to foot of left leg, both legs flushed; white anæsthetic areas on inner side of right thigh.	—	.....do.....	—	Do.

TABLE 2.—*Results of physical and bacteriological examinations of the skin and nose of children of lepers, November, 1921*—Continued.

No.	Initials.	Age.	Examination of skin.		Examination of nose.		Diagnosis, type of leprosy.
			Physical.	Bacteriological.	Physical.	Bacteriological.	
16	P. I...	*Yrs.* 7	White anæsthetic spot on left cheek and anæsthesia on right ulnar region; pilocarpine test unsatisfactory.	—	Right side negative; small depression anterior portion septum, left side.	—	Maculo-anæsthetic.
17	G. M..	6	White anæsthetic area on back of left side and another similar area about 2.5 centimeters in diameter on right thigh; no sweating in white area.	—	Ulcer anterior portion septum, right side; with atrophic changes of the mucosa of the turbinate on both sides.	—	Do.
18	A. T..	11	Advanced nodular case.	+	Left side infiltration of middle septum and corresponding portion of middle turbinate producing adhesion between the two surfaces; erosion at nasal orifices.	+	Nodular.
19	R. N..	10	Reddish, slightly infiltrated right ear; anæsthesia on left ulnar region; skin on left arm and elbow thickened and reddish; diffuse reddish area on right forearm.	+	Left side negative; small ulcer right side septum, anterior portion.	—	Maculo-nodular.
20	J. R...	10	Marked nodular case.	+	Ulceration and infiltration of right inferior turbinate; two small nodules anterior portion of septum, left side.	+	Nodular.
21	E. S...	10	Maculo-anæsthetic spot on back which does not sweat.	+	Left negative; small ulcer right side septum, anterior portion.	+	Maculo-anæsthetic.
22	J. C...	9	Well-developed nodular case.	+	Small infiltrated area right side of septum, anterior portion; left side negative.	+	Nodular.

TABLE 2.—*Results of physical and bacteriological examinations of the skin and nose of children of lepers, November, 1921*—Continued.

No.	Initials.	Age.	Examination of skin.		Examination of nose.		Diagnosis, type of leprosy.
			Physical.	Bacteriological.	Physical.	Bacteriological.	
		Yrs.					
23	A. C. ..	8	Rounded white patches with red centers on face.	+	Inner aspect right ala nasi with ulcer; superficial ulcer anterior portion septum, left side; corresponding portion of right side slightly swollen and with scab.	+	Macular.
24	B. R. ..	7	White anæsthetic patches all over the body; many of the spots show reddish centers. Some of the spots show sweating and others do not.	+	Small nodule anterior portion septum, right side; thickened right ala.	+	Maculo-anæsthetic.
25	F. R. ...	5	White anæsthetic and anhidrotic spot on back.	+	Nothing abnormal on right side; vestibule left side with scales.	—	Do.
26	P. B. ...	5	Some doubtful spots and a slight infiltration of right cheek; unsatisfactory pilocarpine test.	+	Negative	—	Infiltration.

On examining Table 2 one notices that there exist bacteriologically negative erosions and ulcers in nonleprous children; that some children, showing suspicious, bacteriologically negative lesions in the skin, show erosions, ulcerations, or nodules which are invariably bacteriologically negative; that children who show skin lesions which are bacteriologically positive are not necessarily bacteriologically positive in the nose and that the nose in these cases may either show ulcerations (No. 5, A.N.) or not (No. 25, F.R., and No. 26, P.B.); that in cases in which the bacteriological findings of the nose were positive there were definite lesions in the septum; and that, invariably, bacteriologically positive lesions were found in the skin in cases which are positive bacteriologically in the nose.

Table 3, which summarizes the types of lesions and bacteriological findings in the skin and nose of the twenty-four children

born in the colony who at the present writing are unquestionably lepers, confirms the findings in the preceding table, in that in all of the twenty-four cases lesions of the skin were found positive while only thirteen were bacteriologically positive in scrapings from the septum of the nose; the other eleven were bacteriologically negative in this site.

Our records show two children (No. 13, A.C. and No. 12, A.M., Table 3) who, on former bacteriological examinations, were positive only in skin lesions, and now they are positive bacteriologically in the skin and nose. Two other children (G.D. and P.I.), showing suspicious lesions in the skin, were repeatedly examined bacteriologically with negative results and, after an interval of six months, became positive bacteriologically, only in the skin so far.

Bacteriological but not physical examination was made of the noses of sixty-one other children, from 1 to 12 years old, with negative results. Their skin was also negative bacteriologically and showed lesions; such as flushed skin of the legs only, suspicious or characteristic white patches in some of which there was a definite reddish tint indicating progressive changes, or definite anæsthesia either in white patches or in regions of the body which show no skin blemishes.

Considering the above data, one might conclude that the early lesion is located in the skin and not in the nose. Our results are at variance with the theory of Sticker,(7) who claimed that the nose was the site of the initial lesion of leprosy, and are in conformity with the results obtained by Brinckerhoff and Moore,(1) who concluded that the routine examination of the nasal septum and the nasal secretions is not an efficient method for the detection of leprosy in its incipient stage.

THE NATURE OF THE EARLY LESION

It is natural that in young children it is hard to obtain reliable history as to subjective sensations, and the main reliance on manifestations of the disease must be looked for in the subjective signs in the skin. We have found that the commonest manifestation of the disease is the appearance of macular lesions, which are whitish patches resembling morphea spots and which we refer to here as "macula alba."

The macula alba are whitish light fawn in color, level with the skin, and have a smooth, nonscaly surface and irregular edges of from 1 to 10 centimeters wide. They appear singly and gradually increase in size and number, or they may break out in

crops. The commonest locations are the trunk, buttocks, thighs, arms, and face. They simulate tinea of the skin, commonly called "paño blanco," a common affection among Filipinos, but from which they can be easily distinguished on account of the rounded shape, small size, and elevated furfuraceous surface of the tinea lesions when these are early and discrete; also, scrapings from tinea lesions treated with 10 per cent caustic potash solution show fungi, whereas no fungi are found in the white patches of leprosy. They are differentiated from vitiligo or leucoderma because in these there is often an increase of pigmentation on the border of the patches producing a sharp contrast between the lesion and the surrounding skin, which is not noticed in leprosy.

In the early macula alba there is no loss of hair, no change in the activities of the sudoriferous glands as tested by the injection of pilocarpine, and no change in the sensibility to touch or to heat or cold. The majority of the macula alba are bacteriologically negative, but in older patches, especially those showing a reddish tint, *Bacillus lepræ* may be found.

In some of the white patches that did not show tactile anæsthesia there was noticed an inability to distinguish thermal differences, and in patches where both tactile and thermal anæsthesia existed the thermal was found to be more extensive.

The test for tactile discrimination—that is, ability to distinguish whether the affected region is touched by one or by two points—was not systematically applied, on account of the unreliability of the answers of children.

Injections with pilocarpine nitrate and administration of hot tea in an effort to determine the absence of sweat in certain portions of the body, especially in connection with blemishes and white areas of the skin, were not always satisfactory; as the child, being covered, had the tendency to move and wipe away the moisture. It was noticed in connection with the white areas that in some cases, after injection, the white area was absolutely smooth and dry, whereas the skin in the immediate vicinity was moist; in other cases the white areas were dry, but the immediately surrounding skin was also dry and the corresponding area of the skin on the other side of the body was also dry. In other cases the white areas showed definite sweating similar to the surrounding skin.

Another early objective sign also seen in the leprosy of children is the shiny and flushed appearance of the legs occurring coincident with, or independent of, the white patches. Also, in-

filtration of the ears or of parts that are frequently subject to friction and traumatism, such as the elbows and knees, may be the first manifestation of the disease.

In some of the older children we were able to elicit a history of paresthesia, hypesthesia, and anæsthesia as the first and, frequently, only manifestation of leprosy. Such disturbances were frequently noticed first on the peroneal side of the leg and the ulnar side of the forearm or on the external maleolus and the back of the elbow joint; and, occasionally, on close examination one can notice also isolated patches of anæsthesia in other parts of the body.

We were not able to see or obtain a clear history of bullæ formation, which is one of the first manifestations of leprosy, pointed out by Dyer(3) and by Gwyther.(4)

Hopkins(5) has already noted that the macular lesion is the most constant of the early manifestations in all types of skin leprosy and that such a macule is usually unaccompanied by symptoms, such as pain or itching, that would likely attract the attention of the patient. We cannot state that all the white patches that we noticed in children are leprous, in the absence of other functional nervous disturbances and other definite leprous lesions. It is significant, however, that such blemishes are so prevalent among the children of lepers, about one-fourth of whom, as noted in Table 5, show this type of lesion with or without concomitant functional nervous changes. On the other hand, we have seen definite evidences of progressive changes in these whitish patches; that is, in the course of time they became reddish, infiltrated, and bacteriologically positive, as shown in Plate 5, figs. 1, 2, and 3. We have also found some white patches (Plate 2, figs. 2 and 3), which were bacteriologically positive, and which on their physical appearance could not be distinguished from bacteriologically negative patches (Plate 1, figs. 1, 2, and 3; and Plate 2, fig. 1).

DEVELOPMENT OF THE DISEASE

After the first lesions, such as white areas, anæsthesia, flushed legs, and infiltrations, the disease progresses by the aggravation of the preceding conditions. The white areas increase in number, may remain white or may acquire reddish edges (Plate 4, fig. 1; and Plate 5, fig. 3) or centers (Plate 5, figs. 1 and 2), may become more or less elevated, and previously bacteriologically negative patches may become positive. The infiltrations become more accentuated, and nodules appear on the ear, the

face, and other parts of the body. The skin of the legs becomes dry and scaly, suggesting ichthyosis. Single ulcers break out on the legs and the feet, which are chronic and difficult to heal. Anæsthesia may be noticed in connection with other lesions, but occasionally this is about the only definite sign of leprosy present, the patient being bacteriologically negative and showing neither thickening of the superficial nerves nor other physical appearance indicative of trophic disturbances.

The development of leprosy is suggested by the type of lesions that appear in children, according to their age, as shown in Table 3.

TABLE 3.—*Positive lepers, arranged in order of age.*

No.	Initials.	Year of birth.	Age.	Sex.	Lesions arranged according to order of appearance.	Bacteriology.	
						Skin.	Nose.
			Yrs.				
1	C. B	1918	3	M	Macules white and one red macule	+	—
2	A. de L	1917	4	F	One white macule	+	+
3	R. R	1917	4	F	Macules white	+	—
4	M. G	1917	4	M	Macules white and red	+	—
5	F. R	1916	5	M	Macules white	+	—
6	G. D	1916	5	F	Macules white and red; nodules	+	—
7	T. R	1915	6	M	Macules white	+	—
8	I. P	1915	6	F	ditto	+	—
9	B. R	1914	7	M	Macules white and red; infiltration; anæsthesia.	+	+
10	P. I	1914	7	F	Macules white and red	+	—
11	F. B	1914	7	M	Macules white	+	—
12	A. M	1913	8	F	Macules white; anæsthesia	+	+
13	A. C	1913	8	F	Macules white and red	+	+
14	F. Z	1912	9	M	Nodules	+	+
15	G. M	1912	9	M	Macules white; infiltration	+	+
16	J. C	1912	9	F	Nodules; macules white and red; anæsthesia	+	+
17	A. C	1912	9	M	Anæsthesia; nodules	+	+
18	E. S	1911	10	M	Macules white	+	+
19	J. R	1911	10	M	Anæsthesia; nodules	+	+
20	R. N	1911	10	F	Infiltration; anæsthesia	+	—
21	A. T	1910	11	F	Macules white; nodules; anæsthesia	+	+
22	D. S	1909	12	F	Macules white; anæsthesia	+	—
23	E. R	1909	12	F	Macules white; nodules; anæsthesia	+	+
24	F. S	1908	13	M	Anæsthesia; nodules; macules white	+	+

Table 3 has been arranged according to the correlative age of the children, and the types of lesions are listed in the order of their appearance as far as could be ascertained. It shows that the majority of the younger children, while bacteriologically positive in the skin, are negative in the nose; also that, as a general rule, the younger children show only macular lesions and, as the children grow older, infiltrations, anæsthesia, and

nodules appear; and that, with the exception of two cases (F.S. and J.C.), when macular lesions (usually whitish) coexist with other lesions, the former appear first; in four cases there were no macular patches and in two of these (J.R. and A.C.) anæsthesia preceded the nodules, in one there were infiltration and anæsthesia, and in another only nodules.

The early lesion and the development of leprosy are also illustrated by the following records of children who are bacteriologically positive lepers:

I.—C.B. (Table 3, No. 1), Filipino, 3 years old, male. Born in Culion. Father nonleper, living outside. The mother and maternal grandfather are lepers living in Culion. One sister 15 years old, one brother 13 years old, and one sister 8 years old are nonlepers living outside.

He has been living since birth within the leper population. In June, 1921, this child was negative physically and bacteriologically. In February, 1922, he showed several white areas on the left cheek, right loin, right buttock, external surface of right thigh, posterior surface of left thigh, posterior surface of right arm, ulnar side of right forearm, and back of left arm, and two slightly elevated areas on the surface of the left thigh. There was one white area on the anterior surface of the left forearm which showed an elevated, infiltrated, distinctly red center (Plate 5, fig. 1). The skin of both legs was flushed. There was no anæsthesia. There were some scars due to scabies. The nose was negative on physical examination. According to the mother the first spot that appeared was the one on the left cheek, about eight months ago; three months later the area on the right buttock and the rest of the patches appeared in rapid succession, practically at the same time. The reddening and infiltration of the center of the white patch on the left forearm was noticed only about one month ago.

The bacteriological examination in February, 1922, showed bacilli in the white patches, but much more numerous in the red center of the area of the left forearm. The nasal septum was bacteriologically negative.

II.—G.D. (Table 3, No. 6), Filipino, 5 years old, female, born in Culion in 1916. Both parents lepers, mother dead, father alive and residing in the Culion Leper Colony. One sister, S., nonleper, was sent away from Culion; another, L., 4 years old, now in Culion, has suspicious lesions which are bacteriologically negative.

G. was isolated in the Negative Children's House at the age of 1 year and 6 months, and was discharged two and a half years later, on account of the development of white nonanæsthetic areas, suspicious of leprosy. In June, 1921, she showed whitish areas all over the body and flushed, shiny, scaly legs; the white areas and the nose were bacteriologically negative. In September and November, 1921, the patches remained about the same (Plate 4, fig. 1), the scrapings from the spots and from the nose were still negative for *B. lepræ;* injection of 0.001 gram pilocarpine nitrate and administration of hot tea failed to elicit sweating in the white areas.

In February, 1922, the white areas all over the body showed reddish elevated borders (Plate 5, fig. 3), the face was reddish, and there were small nodules on both ears. The legs were still flushed and scaly. The

nodules of the ears and the reddish white patches were found bacteriologically positive, and the septum of the nose was negative.

The physical examination of the nose in February, 1922, showed catarrh, with the left side of the septum thickened, and the right side smooth and normal. A previous examination in November, 1921, gave negative findings on both sides of the septum of the nose (Table 2, No. 12).

III.—A.C. (Table 3, No. 13), Filipino, 8 years old, female, born in Culion in 1913. Both parents living and lepers, residing in the Culion Leper Colony. There are two sisters: P., 7 years old, nonleper, and C., 6 years old, and one brother S., 4 years old, who are considered clinically as lepers although they are bacteriologically negative.

A. was isolated in the Negative Children's House when 3 years old, and from there she was discharged after two and one-half years on account of the appearance of white patches which were suspicious of leprosy. There was no record made of the bacteriological findings at the time of her discharge.

At present she shows white areas, with red circular patches in the center, on both cheeks and chin (Plate 5, fig. 2); one extensive, faint, whitish area on the left scapular region; and several white, reddish areas on the left ulnar region. There are no nodules or infiltration of the ears. On the left ulnar region and on the posteroexternal surface of both legs there is both thermal and tactile anæsthesia. The legs are reddish and scaly, and there is ecthymatous itch over elbows, buttocks, thighs, and feet.

The nose, examined in November, 1921 (Table 2, No. 23), showed inner aspect of right ala nasi with ulcer; superficial ulcer, anterior portion of septum, left side; corresponding portion of right side slightly swollen and with scab.

The bacteriological examination in June, 1921, showed the nose negative and the skin positive; in November, 1921, both the nose and the skin were positive for *B. lepræ*.

IV.—A.M. (Table 3, No. 12), Filipino, 8 years old, female. Born in Culion. Both parents were lepers, now dead. No brothers or sisters. There is no reliable history obtainable on account of the death of the parents, but she says that the white areas appeared at the same time.

Her condition on February 20, 1922, showed whitish areas of different shapes and sizes on chest, abdomen, back, and loin. The buttocks and legs showed the same color as the whitish areas, indicating that they consist of white confluent areas. The face was red and infiltrated. Both ears showed small nodules. The legs were red, dry, and scaly. There was ulceration on the right leg. The left forearm was also scaly. The white areas were not anæsthetic, and in November, 1921, they showed sweating on administration of pilocarpine and hot tea. There is slight anæsthesia on the anterior surface of the left forearm, both to temperature and to touch. The infiltration of the face and the nodules on the ears were not present on former examinations in June and September, 1921, when her picture was taken (Plate 4, fig. 3). There is also ecthymatous scabies on both legs and abdomen.

The examination of the nose showed the right side of the septum with nodulelike swelling, the apex of which seems eroded and ulcerated, the left side of the septum being normal.

Bacteriological examinations repeatedly made, June to November, 1921, showed the skin positive and the nose negative. On February 20, 1922,

scrapings from lesions of the skin and the septum of the nose were positive for *B. lepræ.*

V.—E.R. (Table 3, No. 23), Filipino, 12 years old, female. Born in Culion. Both parents, now dead, were lepers. No brothers or sisters.

First lesions that appeared were two whitish areas on the back; later such areas became numerous and extensive; then nodules appeared, first on both elbows and knees, then on the hands and feet and, later, on the alæ nasi, chin, and ears (Plate 6, fig. 1).

Her condition on February 18, 1922, was briefly as follows: Nodules on ears, alæ nasi, chin, both elbows, and forearms, and nodular masses on hands and knees. Infiltrations on cheeks, both forearms, nates, thighs, legs, and feet. Extensive white areas on trunk and arms. Legs dry and scaly. Inguinal glands on both sides enlarged. Axillary glands not palpable. There was no falling out of eyebrows. The white areas in parts were denuded of hair, but in most cases the hair was normal.

Thermal and tactile anæsthesia on the ulnar region, both sides, and on both calves; thermal anæthesia only on both elbows and tendo achillis; no thermal or tactile anæsthesia on the white areas.

The nose shows scabs and ulceration on both sides of the septum and on the left ala nasi; there was bleeding on detaching the scabs.

The bacteriological findings were positive for the white areas, nodules, and the septum of the nose.

VI.—F.S. (Table 3, No. 24), Filipino, 13 years old, male. Born in Culion. Both parents, now dead, were lepers. No brothers or sisters.

The disease commenced several years ago with anæsthesia on the elbows and on the knees. Later there was infiltration on both ears, and then the appearance of nodules. Two months ago numerous white areas appeared on the trunk (Plate 6, fig. 2). There has been no prodromal chill and fever; nor were there any paresthetic symptoms.

At present (February, 1922) there are typical nodules on the ears and on the right side of the alæ of the nose. There is infiltration on both cheeks. The femoral glands are greatly enlarged, and the inguinal and axillary glands are palpable. The small finger of the right hand is thickened but is not anæsthetic to touch. Both ulnar nerves are slightly thickened, but there is no tactile anæsthesia on the forearms. There is thermal and tactile anæsthesia on the thighs and in the neighborhood of the knees. The trunk and chest show white nonanæsthetic areas. The skin on both arms and legs is dry and scurfy.

The bacteriological examination was positive of smears made from the white areas, nodules, the juice aspirated from the left inguinal gland, and the septum of the nose.

The type of suspicious or definite leprosy lesions occurring among brothers and sisters of different ages is indicative of the period of development of leprosy and suggests that the white patches in the skin of children are either leprous spots or precursors of definite leper manifestations. The following notes on children of the same parents serve to verify this statement:

1.—"I." E., 11 years old, female, was previously suspicious, showing a thickening in the region of the Darwinian tubercle of the ear and a whitish area on the left side of the face which was slightly reddish;

later both the ear infiltration and the face area disappeared after injections with ethyl ester of chaulmoogra oil and sodium cacodylate. P., 7 years old, female, is a positive leper (Table 3, No. 10). G., 3 years old, female, is negative.

2.—"C." J., 9 years old, female, is a positive leper (Table 3, No. 16). D., 8 years old, female, is a suspicious leper, showing white area on the right loin and shiny legs. M., 7 years old, female, is negative.

3.—"N." R., 10 years old, female, is a positive leper (Table 3, No. 20). B., 7 years old, male, is negative.

4.—"C." A., 8 years old, female, is a positive leper (Table 3, No. 13). P., 7 years old, female, is a nonleper. C., 6 years old, female, shows an extensive whitish area on and above right knee which is anæsthetic to temperature but not to touch. S., 4 years old, male, shows whitish areas on back, above both knees, and on the right knee.

5.—"D." G., 5 years old, female, is a positive leper (Table 3, No. 6). L., 4 years old, female, shows small white spots on the right cheek and right arm, and flushed, shiny legs. S., 3 years old, female, sent away from Culion when about 5 months old.

6.—"R." There are five living children of a leper mother and a healthy father. J., 30 years old, female, and M., 20 years old, female, are lepers living now in Culion. Three younger brothers, aged 10, 9, and 7 years, respectively, are nonlepers and live in Tarlac Province. The mother, living in Culion, has borne another child by a leper father and this one, M. G., 4 years old, male, is now a positive leper (Table 3, No. 4).

Leper lesions occasionally disappear spontaneously, as has been observed in one child, P.B., 5 years old, male, who was isolated in the Negative Children's House and later was discharged for suspicious leprosy. In June, 1921, he presented a reddish infiltrated area on the left cheek which was bacteriologically positive, but on February 20, 1922, and without treatment, the infiltration was negative. In our records there are four other children that showed, on first examination, bacteriologically negative white patches, but eight months later some or all of the patches disappeared.

THE EFFECT OF SEGREGATION ON THE DEVELOPMENT OF THE DISEASE

Since 1913 fifty-one children were transferred from Culion for adoption outside of the island. The age of the majority on transfer was between 4 months and 3 years; only one was 4 years, and another was 10 years of age. The children at the time of transfer were negative, physically and bacteriologically.

So far three have been returned to the colony: two on account of leprosy, and one on account of the request of the father who is in the colony, as he thought the child was not being properly taken care of.

The two children returned for leprosy were the following: G.M., male, born in Culion February 1, 1912; transferred away on March 23, 1914, at the age of 2 years and 2 months; on

September 7, 1921, was admitted to San Lazaro Hospital, Manila, as a leper, maculo-anæsthetic type, and returned to Culion on November 17, 1921, at the age of 9 years. A.C., born in Culion on May 26, 1912; transferred on April 23, 1914, at the age of 1 year and 11 months; returned to the colony about May 17, 1917, at the age of 5 years, and at the present writing the disease is of the nodular and anæsthetic type.

Beginning with the year 1916, an effort has been made to segregate physically and bacteriologically negative children in a house located on the site reserved for the healthy residents of the colony. Since the implantation of this policy in March, 1916, to October 6, 1921, there were isolated 83 children, of which 22 remain negative, 25 have died, 5 were transferred outside of the colony, 5 were returned to the leper population for other diseases, and 26 were returned for leprosy or suspicious signs of leprosy. No records were made of the physical and bacteriological findings at the time of discharge of the children.

TABLE 4.—*Children isolated at the Negative Children's House as nonlepers and later returned to the colony on account of definite or suspicious signs of leprosy.*

[(+) Positive clinically and bacteriologically.]

No.	Initials.	Date of birth.	Age on January 1, 1922.			Age when isolated.			Age when definite or suspicious signs of leprosy developed.			Period of isolation.		
			Y.	*m.*	*d.*	*Y.*	*m.*	*d.*	*Y.*	*m.*	*d.*	*Y.*	*m.*	*d.*
1	J. R. (+)	March 30, 1911	10	9	1	5	1	26	5	5	25	0	3	29
2	A. T. (+)	February 19, 1910	11	10	12	6	4	28	6	11	13	0	6	15
3	P. I. (+)	June 25, 1914	7	6	6	1	9	0	2	6	7	0	3	7
4	B. R. (+)	June 14, 1914	7	6	17	2	1	3	2	10	(?)	0	9	0
5	E. S. (+)	September 8, 1911	10	3	23	4	10	19	6	(?)		1	2	(?)
6	R. N. (+)	October 17, 1911	10	2	14	4	5	12	5	8	13	1	2	2
7	F. A	January 20, 1919	2	11	11	1	4	0	2	7	18	1	3	18
8	A. F	June 13, 1914	7	6	18	1	11	13	3	5	26	1	6	13
9	V. C	September 8, 1913	8	3	23	2	10	9	4	6	25	1	8	16
10	L. de C	February 20, 1913	8	10	11	3	3	6	5	0	27	1	9	21
11	A. V. S. (+)	November 8, 1913	8	1	23	4	8	12	6	7	10	2	3	16
12	F. R. (+)	August 21, 1916	5	4	10	1	0	7	3	4	25	2	4	12
13	G. D. (+)	April 3, 1916	5	8	28	1	4	24	3	9	7	2	4	13
14	A. N	August 15, 1913	8	4	16	2	7	23	5	5	3	2	5	2
15	A. C. (+)	April 21, 1913	8	8	10	3	2	26	5	8	27	2	6	1
16	L. T	November 11, 1913	8	1	20	2	4	14	4	11	14	2	7	0
17	G. M	February 2, 1915	6	10	29	1	1	19	3	11	16	2	9	17
18	P. B. (+)	July 13, 1916	5	5	18	1	1	15	3	9	3	2	9	18
19	M. L	April 26, 1915	5	8	6	0	10	29	3	8	22	2	9	28
20	M. Z	January 16, 1909	12	11	15	7	10	24	10	11	24	3	1	0
21	J. C. (+)	February 24, 1912	9	10	7	4	4	28	6	7	21	3	2	28
22	M. C	April 14, 1913	8	8	17	2	11	24	7	2	2	4	2	8

The 26 children discharged for leprosy or suspicious signs of leprosy were repeatedly examined during the period from June, 1921, to February, 1922, and 4 were found nonlepers, 11 showed suspicious signs of leprosy but were bacteriologically negative, and 11 were clinically and bacteriologically positive. A tabulation is given (Table 4) to show the age at which the suspicious or definite leprosy developed and the period of segregation before such development, that would indicate the minimum period of time at which a latent leprosy may manifest itself.

Glancing over Table 4, one notices that children isolated at as early an age as one year (No. 12) developed later signs of leprosy confirmed by bacteriological examination; and that definite leprosy may appear within a period of between four months (No. 1) and three years and three months (No. 21) after isolation. The two cases transferred outside of Culion and later returned as positive probably developed the disease much earlier than the date of their return, as they no doubt escaped detection for a long time. Several months or years may elapse, therefore, after contact or association with lepers has ceased, before suspicious or definite signs of leprosy develop.

INCIDENCE OF LEPROSY AMONG THE CHILDREN OF LEPERS

Denney(2) has already published data regarding the incidence of leprosy among the children of lepers born in Culion. Our figures give the results of a general survey made in February and March, 1922, of all the children born and living in Culion up to December 31, 1921, and take into account other details not previously considered. The total number of children examined was 308, of which 153 were males and 155 females. The results are shown in Table 5. Both parents of practically all the children examined were lepers.

The children have been classified into positive lepers, clinical lepers, suspicious, and negatives or nonlepers. Positive lepers are those who show definite clinical signs of leprosy and in whom *Bacillus lepræ* has been demonstrated. Clinical lepers are those who are negative bacteriologically, but who show at least one of the following symptoms: (*a*) Anæsthesia in the ulnar or peroneal region which cannot be attributed to other diseases; or (*b*) whitish patches which show definite anæsthesia, either thermal only or both thermal and tactile; or reddish tint indicative of progressive changes; or which definitely show no sweating on pilocarpine injection, in contrast with the surrounding normal skin and its corresponding symmetrical area on the other

side of the body. The suspicious cases are those that are also negative bacteriologically, and show whitish patches which are not anæsthetic and which show definite or doubtful sweating on pilocarpine injection, or they may show only flushed shiny legs. Negatives, or nonlepers, are those who are bacteriologically negative and on whom no suspicious blemishes or lesions are found in the skin.

TABLE 5.—*Incidence of leprosy in the children of leper parents.*

Age in years.	Children examined.			Positive lepers.				Clinical lepers.			
	Males.	Females.	Total.	Males.	Females.	Total.		Males.	Females.	Total.	
							P. ct.				*P. ct.*
Under 1	15	17	32								
1	25	17	42								
2	13	15	28						1	1	3.57
3	25	15	40	1		1	2.5				
4	19	20	39	1	2	3	7.69	5	2	7	17.9
5	9	8	17	1	1	2	11.76				
6	15	21	36	1	1	2	5.33	1	3	4	11
7	12	12	24	2	1	3	12.50	1	1	2	8.33
8	6	16	22		2	2	9.09	1	3	4	18
9	6	3	9	3	1	4	44.44				
10	5	3	8	2	1	3	37.50				
11		4	4		1	1	25				
12	1	4	5		2	2	40	1	1	2	40
13	2		2	1		1	50				
Total	153	155	308	12	12	24	7.79	9	11	20	6.4

Age in years.	Suspicious.				Negatives.			
	Males.	Females.	Total.		Males.	Females.	Total.	
				P. ct.				*P. ct.*
Under 1					15	17	32	100
1	3	3	6	11.904	22	14	36	85.71
2	2	2	4	14.27	11	12	23	82.14
3	9	4	13	32.5	15	11	26	65
4	5	6	11	28.2	9	9	18	46.15
5	2	4	6	35.29	6	3	9	52.94
6	7	3	10	27.7	6	14	20	55.55
7	1		1	4.17	8	10	18	75
8	1	4	5	22.72	4	7	11	50
9					3	2	5	55.55
10	1	1	2	25	2	1	3	37.5
11						3	3	75
12						1	1	20
13					1		1	50
Total	31	27	58	18.8	102	104	206	66.8

Analyzing the data in Table 5, we notice that the positive lepers number 24, or 7.79 per cent of the total number of children (308) examined; of these 12 are males and 12 are females. The clinical lepers numbers 20, or 6.4 per cent; the suspicious, 58, or 18.8 per cent; and the nonlepers, 206, or 66.8 per cent. The distribution between sexes is practically the same, except in the clinical lepers among whom there is a greater number of females.

The incidence of the disease is greater as the children grow older. Taking the cases of undoubted leprosy, the positive lepers, and separating the children into three age groups in order to get average data for comparison, we find that there are 19 children from 10 to 13 years of age, inclusive, of which 7, or 36.8 per cent, are positive lepers; 108 children from 5 to 9 years, inclusive, of which 13, or 12 per cent, are positive lepers; and 181 children under 5 years of age, of which 4, or 2 per cent, are positive lepers. The youngest child found positive was 3 years old; the youngest child only clinically a leper was 2 years old; and the youngest children with suspicious blemishes were 1 year old.

SUMMARY AND CONCLUSIONS

The children born of leper parents show about the same susceptibility to other morbid conditions as children of nonleper parentage. The mortality on account of congenital debility is higher than in children born in nonleper populations, but this greater mortality due to congenital debility is counterbalanced by the lesser mortality due to infantile beriberi, a disease that has practically disappeared in Culion on account of the exclusive use of unpolished rice as the staple article of diet.

Our data indicate that the most-frequent recognizable site of the early lesion of leprosy is the skin, and that the infection through this route is greatly favored, presumably, on account of the great prevalence of skin diseases among the children, which offer anatomical conditions favorable to the invasion of the lepra bacillus.

The most-frequent recognizable early lesion of leprosy is macular lesion of the skin. In Filipino children this manifests itself in whitish, fawn-colored patches, which at the beginning may not show the bacillus of leprosy or disturbances that may be attributed to the innervation of the affected region, such as diminution in the sense of touch, thermal discrimination, sensibility to pain, or disturbance in the secretory power of the sweat glands. Later, when nervous disturbances become appa-

rent, the sense of thermal discrimination—that is, ability to distinguish between hot and cold—is the first one affected.

The white patches, macula alba, are either precursors of other cutaneous or nervous leprous manifestations, or they themselves develop into definite progressive and bacteriologically positive leprous lesions with concomitant thermal and tactile anæsthesia and anhidrosis.

In a few instances we noticed the disappearance, without treatment, of leprous lesions that were either negative or positive bacteriologically.

Children that have lived in intimate contact with lepers for varying lengths of time may develop leprosy, several months or years after they were isolated from lepers. The shortest period in our series was four months, and so far the longest period was three years and three months after isolation.

The survey made of 308 children of leper parents born and living at the time in Culion Island show 24, or 7.79 per cent, positive lepers and 78, or 25 per cent, with suspicious or definite signs of leprosy though not bacteriologically positive. The leprosy in children affects both sexes about equally. The incidence of leprosy is in direct ratio to the age of the child: the older the child the greater the incidence. The youngest child found to be a positive leper was 3 years old, but suspicious blemishes have been found in children as young as 1 year of age.

REFERENCES

1. Brinckerhoff, W. R., and Moore, W. L. Studies upon Leprosy, IV. Upon the utility of examination of nose and nasal secretions for the detection of incipient cases of leprosy. U. S. Government Printing Office, Washington (1909); also U. S. Public Health Bull. **27** (1909).
2. Denney, O. E. A statistical study of leprosy in the Philippine Islands. Journ. Am. Med. Assoc. **69** (1917) 2171.
3. Dyer, Isadore. The dermatologic aspects of leprosy. Journ. Am. Med. Assoc. **61** (1913) 950.
4. Gwyther, A. Is there a primary lesion in leprosy? Ind. Med. Gaz. **50** (1915) 41.
5. Hopkins, Ralph. Early manifestations of leprosy. New Orleans Med. and Surg. Journ. **70** (1917–1918) 56.
6. Population and Mortality of the Philippine Islands, Philippine Census, Bull. No. 4, Manila (1918) 86.
7. Sticker, Georg. Mittheilungen über Lepra nach Erfahrungen in Indien und Egypten. Münch. med. Woch. **44** (1897) 1063, 1103.

ILLUSTRATIONS

[Photographs by E. Cortes, Bureau of Science.]

PLATE 1. SINGLE SUSPICIOUS, WHITISH; BACTERIOLOGICALLY NEGATIVE AREAS

FIG. 1. J.B., 2 years old. Whitish area on the right buttock. Photographed on March 3, 1922.

2. White area noticed one year ago on the left cheek of B.B., 4 years old. Photographed on March 3, 1922.

3. White area on buttock, four years' duration, on A.T., 7 years old, female. Photographed on September 13, 1921.

PLATE 2. FURTHER PROGRESS OF WHITE AREAS

FIG. 1. A.L., 3 years old. White area on the external surface of the left thigh, of about eight months' duration, and white area on the left cheek, which are at present bacteriologically negative. Vaccination mark on the left arm. Photographed on March 3, 1922.

2. A. de L., 4 years old, female. White area on the right loin which is bacteriologically positive and is the only leprous lesion in this child. Photographed on March 3, 1922.

3. T.R., 6 years old, male. White areas on the back of the left arm of two years' duration which are bacteriologically positive. They are the only leprous lesions found in this case. Adjoining the areas, there are lesions of chronic "itch" which might have predisposed to the development of the leprous lesions. Photographed on March 3, 1922.

PLATE 3. DEVELOPMENT OF FLUSHED, SHINY, AND SCALY LEGS

FIG. 1. L.D., female, 4 years old, bacteriologically negative at the time. Photographed on September 13, 1921.

2. G.D., female, 5 years old, sister of L.D. in fig. 1, also bacteriologically negative at the time. Photographed at the same time as fig. 1, September 13, 1921.

3. A.M., female, 8 years old, who is bacteriologically positive. The scaliness of the legs is more marked. A trophic ulcer is also shown on the right leg. Photographed on September 13, 1921.

PLATE 4. MULTIPLE WHITE LEPROUS AREAS

FIG. 1. D. sisters. They are the children whose legs are shown larger in Plate 3, figs. 1 and 2. The older girl, G., five years old, shows white areas all over the body, and the younger one, L., 4 years old, faint whitish areas on the right side of chin and right arm. Both bacteriologically negative at the time. Photographed on September 13, 1921.

2. F.B., 7 years old. White areas all over the body which are bacteriologically positive and on injection of pilocarpine show no sweating. These patches appeared about one year ago and were preceded by a white area on the right cheek which was noticed when he was hardly over 1 year old. Photographed on March 3, 1922.
3. A.M., 8 years old. White areas of different sizes and shapes all over the body which appeared in crops and are bacteriologically positive. Ulceration on right leg and scaliness of the skin of both legs is shown more plainly in Plate 3, fig. 3. Photographed on September 13, 1921.

PLATE 5. PROGRESSIVE CHANGES IN THE LEPROUS PATCHES

FIG. 1. C.B., 3 years old, male. White areas on face and chest and one white area on anterior surface of the left forearm which recently showed reddening and infiltration and on which the number of bacteria found are more numerous than on the white spots. Photographed on March 3, 1922.
2. A.C., 8 years old. White areas on cheek, with red centers which developed later, indicating progressive changes. Bacteriologically positive in these lesions and in the nasal septum. Photographed on September 13, 1921.
3. This is the older girl represented in Plate 4, fig. 1, who was examined and photographed about six months later. Now she shows reddening of the edges of the white areas, flushing of the face, and nodular infiltration of the ears. The red margins of the macules and the nodules of the ear are bacteriologically positive, although the septum of the nose still remains negative. Photographed on March 3, 1922.

PLATE 6. ADVANCED STAGES OF LEPROSY

FIG. 1. E.R., 12 years old. Nodular lesions in the ears, chin, and alæ nasi, and white areas on the chest which preceded the infiltrative and nodular lesions. Bacteriologically positive in the skin lesions and nose. Photographed on March 3, 1922.
2. F.S., 13 years old. Nodules on both ears and infiltration on both cheeks. White areas on the chest appeared recently, after the development of infiltration and nodules. The skin of the chest and arms also shows scars and active lesions of an itchy disease of the skin other than leprosy. Bacteriologically positive in the skin and nose. Photographed on March 3, 1922.

PLATE 1. SINGLE, SUSPICIOUS, WHITISH BACTERIOLOGICALLY NEGATIVE AREAS.

PLATE 2. FURTHER PROGRESS OF WHITE AREAS.

PLATE 3. DEVELOPMENT OF FLUSHED, SHINY, AND SCALY LEGS.

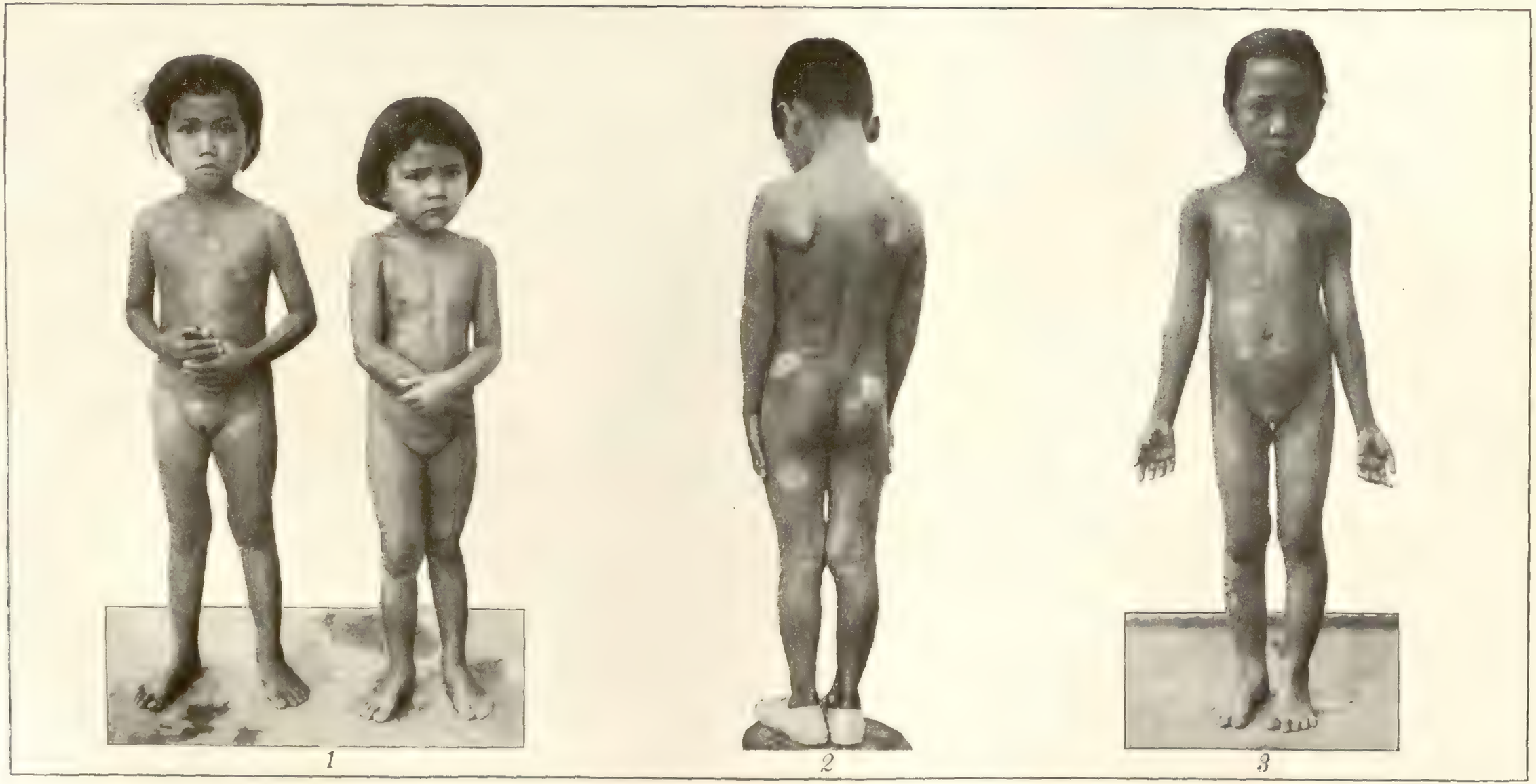

PLATE 4. MULTIPLE WHITE LEPROUS AREAS.

PLATE 5. PROGRESSIVE CHANGES IN THE LEPROUS PATCHES.

PLATE 6. ADVANCED STAGES OF LEPROSY.

ADDITIONS TO THE HERPETOLOGICAL FAUNA OF THE PHILIPPINE ISLANDS, II

By Edward H. Taylor

Of Manila, Philippine Islands

FOUR PLATES

This paper contains descriptions of the following species believed to be new:

AMPHIBIANS

Rana igorota.
Rana yakani.
Rana tafti.
Micrixalus diminutiva.
Cornufer rivularis.
Cornufer montanus.
Cornufer subterrestris.
Polypedates linki.

LIZARDS

Sphenomorphus beyeri.
Tropidophorus stejnegeri.

SNAKE

Natrix barbouri.

The following species are listed with notes on color and scalation and other pertinent data:

AMPHIBIANS

Oxyglossis lævis Günther.
Rana suluensis Taylor.
Rana luzonensis Boulenger.
Rana sanguinea Boettger.
Rana erythræa (Schlegel).
Staurois natator (Günther).
Cornufer corrugatus (Duméril).
Polypedates pardalis (Günther).
Polypedates appendiculatus (Günther).
Kalophrynus stellatus Stejneger.
Bufo philippinicus Boulenger.
Megalophrys stejnegeri Taylor.

LIZARDS

Lepidodactylus divergens Taylor.
Lepidodactylus aureolineatus Taylor.
Sphenomorphus luzonensis (Boulenger).
Brachymeles gracilis (Fischer).
Brachymeles schadenbergi (Fischer).
Brachymeles vermis Taylor.
Dibamus argenteus Taylor.

SNAKES

Natrix lineata (Peters).
Natrix dendrophiops (Günther).
Oxyrhabdium modestum (Duméril and Bibron).
Oxyrhabdium leporinum (Günther).
Zaocys luzonensis Günther.
Holarchus meyerinkii (Steindachner).
Psammodynastes pulverulentus (Boie).

Boiga dendrophila divergens Taylor.
Hemibungarus calligaster (Wiegmann).
Hemibungarus mcclungi Taylor.
Doliophis philippinus (Günther).
Naja naja philippinensis Taylor.
Naja naja samarensis (Peters).
Trimeresurus wagleri wagleri (Boie).

Rana guerreroi Taylor has been relegated to the synonymy of *Rana luzonensis* Boulenger. The species was established on immature specimens but the study of a large series of larvæ, young, half-grown, and adult specimens obtained in 1920 makes this action imperative.

Under *Natrix barbouri* sp. nov., I have endeavored to show that *Natrix crebripunctata* (Wiegmann) should be eliminated from lists of Philippine snakes, since it is beyond question a name based on a young specimen of *Natrix spilogaster* (Boie).

AMPHIBIANS

Oxyglossis lævis Günther.

Oxyglossis lævis GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 6, pl. 1, fig. A; TAYLOR, Amphibians and Turtles of the Philippine Islands (1921) 30.

I obtained specimens in Kalinga and Polillo; on Mount Mariveles, Mount Banahao, and Mount Maquiling; at Zamboanga; and on Basilan. In each of these localities the species occurred in abundance. I failed to find specimens in Jolo. I have reported specimens from "Sulu Archipelago"[1] but fail to find in my records any mention of collections in Sulu. Usually where the species occurs it is very common and is the first species one picks up. It probably does not occur in Jolo.

Philippine specimens of this species appear to be larger than those from southeastern Asia. Many of my specimens are more than 50 millimeters long from snout to vent. Occasional specimens are more than 60 millimeters long. Published records from extra-Philippine localities give much smaller measurements. The tips of the digits appear to be more widened in Philippine specimens.

Rana suluensis Taylor. Plate 1, fig. 2.

Rana suluensis TAYLOR, Philip. Journ. Sci. 16 (1920) 264; Amphibians and Turtles of the Philippine Islands (1921) 65.

Two specimens of *Rana suluensis* were taken along a small stream in central Jolo, near the Government cattle ranch. The specimens agree very well with the type save in the presence of very distinct dorsolateral folds. Certain young cotypes, how-

[1] Loc. cit.

ever, had narrow folds. As the type has not been figured I include a photograph of one of the Jolo specimens, somewhat enlarged. The type locality is Tawitawi, an island to the southwest of Jolo.

Rana luzonensis Boulenger.

Rana luzonensis BOULENGER, Ann. & Mag. Nat. Hist. VI 17 (1896) 401; TAYLOR, Philip. Journ. Sci. 16 (1920) 254; Amphibians and Turtles of the Philippine Islands (1921) 55.

Rana guerreroi TAYLOR, Philip. Journ. Sci. 16 (1920) 255; Amphibians and Turtles of the Philippine Islands (1921) 56.

A number of specimens which I have referred to *Rana luzonensis* Boulenger were taken at Baguio and at various places along the trail to Bontoc. Larvæ were obtained near the Bontoc-Lepanto boundary from an old Bontoc fisherman, who had a small tin nearly filled with the larvæ. He had taken them for food, from a mountain stream near the trail. Larvæ and newly transformed young were taken at the town of Bontoc in the river and among the stones forming the walls of the rice paddies. A study of this series of larvæ and young and adult specimens has convinced me that my *Rana guerreroi* is the young of *Rana luzonensis*.

Measurements of Rana luzonensis Boulenger.

	No. 662.	No. 713.
	mm.	*mm.*
Snout to vent	58	53
Length of head	21	20
Width of head	17	14
Diameter of eye	6.7	6.5
Eye to end of snout	9.5	9
Eye to nostril	6	5.3
Upper eyelid	5	5
Interorbital space	5	5
Forelimb	39	34
Longest finger, with hand	19	15
Hind limb	109	97
Femur	32	30
Tibia	36.5	32
Longest toe, to metatarsal tubercle	32	25

Color in life.—(No. 662.) Above grayish to yellow-brown, with numerous blackish flecks on back; a black loreal streak and a black-brown tympanic spot; a brown spot near insertion of arm on underside; a light yellowish line from under eye to angle of mouth; limbs strongly barred with dark brown; chin and throat uniform purplish, growing brown on belly; soles dark with lighter tubercles; underside of arm cream, without spots.

The specimens vary considerably among themselves in color; one specimen (No. 718) is uniform reddish to red-brown above, posterior part of belly yellow to yellow-green, anterior part of throat and chin cream white.

Two other specimens were somewhat yellow-brown to olive above, with subarticular tubercles cream yellow. In one specimen (No. 664) the black spots are wanting on the side of the head.

The adult specimens were taken in various localities. One specimen was on the trunk of a growing tree concealed in moss, at a distance of about 2 meters from the ground. Three specimens were found in a rotten log lying across a small mountain brook, 14 kilometers north of Baguio near the trail. Young specimens were taken under stones near small brooks and rivers.

Rana igorota sp. nov. Plate 3, fig. 1.

Type.—No. F786, E. H. Taylor collection; collected April 28, 1920, at Balbalan, Kalinga Subprovince, northern Luzon, by E. H. Taylor.

Description of type.—Choanæ moderate, rather hidden by overhanging jaw; vomerine teeth in two series lying between and behind choanæ, separated from latter by a distance equal to length of one series, separated from one another by a distance somewhat less; tongue large with two elongate horns widely separated at base; snout elongate; head much longer than wide; eye a little shorter than snout; nostril nearer end of snout than eye; loreal region nearly perpendicular, strongly concave; tympanum large, separated from eye by a distance less than half the diameter of tympanum; distance between nostrils slightly greater than their distance from eye; interorbital distance equal to or a little less than upper eyelid; skin on head smooth; no tubercles on eyelids; back smooth save in posterior part where there are small scattered tubercles; a very narrow, distinct, tubercular, dorsolateral, glandular fold present; a glandular fold below tympanum turning down at its posterior end and terminating in a tubercle; upper surface of tibia with strong, scattered tubercles; belly granular in posterior part; chin and throat smooth; posterior and inferior aspects of femur largely granular; fingers with very broad disks, equal to two-thirds the diameter of tympanum, on the two outer fingers; disks smaller on the two inner fingers; first finger greatly thickened at base, distinctly shorter than second; subarticular tubercles distinct; palmar and carpal tubercles rather dim; toes with well-

developed, somewhat pointed disks about the size of that on the second finger; toes about four-fifths webbed, the web reaching fourth toe disk by only a very narrow membrane; subarticular tubercles strong; an elongate outer and a small rounded inner metatarsal tubercle; a narrow skin fold on outer side of fifth toe, and on foot; a mere suggestion of a fold on forelimb; hind limb brought forward, the tibiotarsal articulation reaches about halfway between eye and nostril. The type specimen is a female, without vocal sacs.

Color in life.—Above, body green to olive green variegated with numerous rounded bronze spots; sides yellow-green, spotted with olive; belly yellow; lores dark olive; tympanum brown; limbs strongly barred with green and bronze; pads on toes cream yellow; dorsolateral glandular folds golden yellow.

Measurements of the type of Rana igorota sp. nov.

	mm.
Snout to vent	60
Length of head	22
Width of head	18
Length of snout	10
Diameter of eye	8.2
Upper eyelid	6.5
Interorbital area	5
Tympanum	5.5
Forelimb	38
Longest finger, with hand	17
Hind limb	99
Tibia	30
Femur	32
Longest toe, to metatarsal tubercle	25

Variation.—There is considerable variation in markings. In some specimens the rounded spots on the back are dim or almost wanting; likewise the spots on sides. Some of the younger specimens were nearly yellow in life. The distinctness of the granules on back and femur varies. There are nine cotypes, but I fail to find vocal sacs in any of them. Two or three specimens have minute spinelike tubercles on the lower jaw, throat, and breast, and in the area about tympanum. This may be a sexual variation.

Remarks.—This species is related to *Rana luzonensis* but differs materially in numerous characters. The hind limb is shorter in *R. igorota,* the tibiotarsal articulation reaching no farther than the nostril, while in *R. luzonensis* it reaches far beyond the tip of the snout. The snout of *R. igorota* is less flattened, the interorbital area narrower, and the disks on the toes

are slightly wider than in *R. luzonensis*. The color and markings are strikingly different.

Specimens of this species were collected only at Balbalan, Kalinga, on the edge of a small brook. When disturbed they dived in the brook and hid under rocks at the bottom, where they were captured.

The name of the species is derived from Igorot, the generic name applied to the peoples inhabiting the central part of northern Luzon.

Rana yakani sp. nov. Plate 1, fig. 1; Plate 2, fig. 1.

Type.—No. 1545, E. H. Taylor collection; collected at Abungabung, Basilan, October 22, 1920, by E. H. Taylor.

Description of type.—Choanæ moderately large, partially concealed by overhanging jaw; vomerine teeth in two small oblique series; separated from choanæ by a distance equal to length of one series, the two series separated by a similar distance; teeth extend much beyond posterior border of choanæ, and do not or scarcely reach anterior border; tongue broad, cordiform, with two rounded horns behind, very narrowly separated at base; a prominent tubercle on tongue, head rather bluntly pointed; snout extending beyond lower lip; canthus rostralis di tinct, rounded; loreal region nearly perpendicular, deeply grooved behind nostril; eye large, diameter of orbit very slightly less than its distance from tip of snout; nostril nearer end of snout than eye; interorbital distance a little less than width of upper eyelid; distance between nostrils equals their distance from eye; tympanum large, distinct, equal to about three-fifths orbit; strong, broad, dorsolateral folds from eye to near anus, converging somewhat posteriorly; no supratympanic fold or, if present, indistinct; upper lip glandular; a glandular fold at corner of mouth and another above insertion of arm; skin on back heavily covered with small granules; snout more or less smooth; upper eyelid granular; granules on limbs arranged in dim longitudinal lines; sides with numerous enlarged tubercles; throat and belly smooth; posterior and inferior aspect of femur strongly granular; a deep elongate groove in middle of back between shoulders; fingers slender, elongate, with distinct disks on tips, about one and one-fourth to one and one-half times as wide as finger; subarticular tubercles strong; carpal and palmar tubercles distinct; first finger distinctly longer than second, extending as far as fourth; no gland on arm; toes with disks larger than those on fingers; disks on both fingers and toes rather pointed; toes about two-thirds webbed, the web reaching

to near disk on outer side of third and inner side of fifth, not more than halfway on first toe, and slightly in advance of the penultimate subarticular tubercle on fourth; subarticular tubercles strong; no tubercles on sole; very strong, inner, metatarsal tubercle and a strong outer one which is only very little smaller than the inner; no fold on outer side of fourth toe of foot; the leg brought forward the tibiotarsal articulation reaches anterior corner of eye or a little farther.

Color in life.—Above olive to bronze brown with darker brown spots and mottlings; dorsolateral glandular fold lighter olive bordered below by a black-brown line; loreal region with a broad band of black-brown; tympanum and side of head dark brown with a lighter area behind eye; sides with yellow tubercles, low on side; belly cream to yellow; limbs strongly barred and mottled with brown; web of foot blackish; fold at corner of mouth yellow.

Measurements of Rana yakani sp. nov.

	No. 1545, ♀.	No. 1603, ♀.	No. 1027, ♂.
	mm.	*mm.*	*mm.*
Length, snout to vent	67	65	48
Length of head	24	24	20
Width of head	21	21	16
Snout	10	9.8	8.5
Eye to nostril	6.5	5.5	5
Upper eyelid	6	6	6
Diameter of eye	9.2	9.3	8
Interorbital distance	5	5.5	4.5
Tympanum	6	6	5.5
Forelimb	38	38	30
Longest finger, with hand	17	16	13.5
Hind limb	104	98	74
Femur	31	29	23
Tibia	35	34	25
Longest toe, to metatarsal tubercule	28	27	21

Variation.—The sexes vary greatly in size. The largest female (No. 1065), from Zamboanga, measures 75 millimeters from snout to vent; the largest male, also from Zamboanga, measures 48 millimeters from snout to vent. There is a certain amount of variation in the size of the eye and the tympanum, and in the distinctness of the granulation on the back. Males are for the most part smoother than females. The groove on the back is invariably present. The tubercle on the tongue is distinct in some specimens and dim or wanting in others. In color, they vary from yellow olive to deep bronze. Males are usually much lighter in color than females. Young females

are usually deeper brown than older specimens, and the sides of the head and body are frequently black. Many specimens have the belly and throat strongly mottled with dusky.

Remarks.—Only two specimens were obtained at Zamboanga along Tumugao River. None were found at Isabela or Port Holland on Basilan, but this species was not uncommon at Abung-abung in the southern part of the island. Females were usually found in the forest at a considerable distance from water. Most of the males were collected in a small forest stream at a point where a tree top had fallen into the water. More than fifty males and but one or two females were captured there.

The species appears to be related to *Rana erythræa* of the Philippines. It differs in markings, in the greater amount of granulation on the back, in having much larger eyes, in the narrower interorbital distance, and in having transverse bars instead of longitudinal lines on the femur and tibia; the outer metatarsal tubercle is very strong. The last character is wanting in the continental and Malayan *Rana erythræa,* but a small tubercle is evident in specimens supposed to be of this species from Negros and Sibuyan. The name for the species is taken from the tribe of people inhabiting the interior of Basilan.

Rana sanguinea Boettger.

Rana sanguinea BOETTGER, Zool. Anz. 16 (1893) 364; TAYLOR, Amphibians and Turtles of the Philippine Islands (1921) 60.

Specimens of this species were obtained in Busuanga, by Gregorio Lopez, of the Bureau of Science. The specimens are not full grown. The body is reddish brown above, and dark on the sides. The characteristic black mark covering the tympanum is well defined. The throat is dusky with an elongate streak under the point of insertion of the arm, and there are two spots on the back part of the throat.

Rana erythræa (Schlegel).

Hyla erythræa SCHLEGEL, Abbild. Amph. (1837) 27, pl. 9, fig. 3.
Rana erythræa TAYLOR, Philip. Journ. Sci. 16 (1920) 249, pl. 1, fig. 2; text fig. 1; Amphibians and Turtles of the Philippine Islands (1921) 50, pl. 1, fig. 2; text fig. 1.

Specimens of *Rana erythræa* were recently collected on Sibuyan Island. I have also specimens collected in Negros. British Museum specimens from the Philippines bear only the label "Philippines." Fischer,[2] records a specimen from southern Mindanao collected by Doctor Schadenberg in 1881. No other col-

[2] Jahrb. wiss. Anst. Hamburg 2 (1885) 80.

lector has found the species in Mindanao. It would appear that this frog is of very erratic distribution in the Islands. Philippine specimens differ from the ordinary Malayan and continental forms in having a small but distinct outer metatarsal tubercle, a character which alone does not appear to warrant separating the Philippine form under a new name.

Rana tafti sp. nov.

Type.—No. 1849, E. H. Taylor collection; collected in mountains near the Pacific coast of Luzon on the trail between Famy, Laguna Province, and Infanta, Tayabas Province, by Lyman H. Taft and F. X Williams.

Description of type.—Choanæ moderate, partly concealed by overhanging jaw, the distance between them equal to distance from eye to nostril; vomerine teeth in two small, rather rounded, nearly transverse series lying between the choanæ, separated from choanæ and from each other by an equal distance; tongue with two prominent horns posteriorly, widely separated at base; no papilla on tongue; no vocal sacs (probably a female specimen); head much flattened, nostril much nearer point of snout than eye; diameter of orbit equal to distance from nostril; eyes prominent, the upper eyelid slightly less than interorbital distance; distance between nostrils about equal to interorbital distance; tympanum very distinct, very large, longer than high, its length equal to diameter of orbit, separated from orbit by a distance less than one-fourth its length; loreal region perpendicular; a groove behind nostril; canthus rostralis sharply angular; snout rather conical in front of nostrils; skin of head and body smooth or very faintly shagreened; posterior part of eyelid slightly granulate; two strong callous tubercles on head lying on upper, inner edge of eyelid near anterior part, and a small tubercle lying nearly between these; two low callous places in interorbital space; a very strong fold above tympanum which continues the length of the body as a very narrow dorsolateral fold; a very slight fold behind tympanum to arm; a broken glandular fold from angle of mouth to arm, very distinct; sides, breast, and throat smooth; posterior part of belly granular; undersurface of femur and anal region granular; fingers with well-developed disks, rather pointed anteriorly; first finger shorter than second; fourth reaches base of pad on third; no fold on arm; no web at base of fingers; subarticular tubercles very strong, protruding; toes about four-fifths webbed, the membrane failing to reach disks on inner side of second and

third toes, but reaching somewhat beyond penultimate subarticular tubercle on fourth; carpal tubercles prominent; subarticular tubercles on toes very strong; a very small metatarsal tubercle and a still smaller outer tubercle; third and fifth toes nearly equal; disks on toes pointed, much smaller than those on fingers; a slight skin fold on outer side of fifth toe, not continued on foot; no tubercle on heel; tibiotarsal articulation reaches considerably beyond tip of snout.

Color in alcohol.—Above blackish purple, nearly uniform; callous spots on head brown; tympanum brown; latter part of upper jaw whitish; an indistinct light spot under eye and in front of tympanum; arms and legs brownish, barred with darker color; underside of femur and tibia spotted brown; a spot on underside of arm near insertion; throat and belly light; purplish spots low on sides.

Measurements of the type of Rana tafti sp. nov.

	mm.
Snout to vent	42
Length of head	18
Width of head	11.5
Diameter of tympanum	5
Diameter of eye	5
Upper eyelid	4
Interorbital distance	4
Eye to nostril	5
Length of snout	7
Depth of head in front of eyes	3.5
Depth of head at tympanum	4.3
Forelimb	27
Longest finger, to wrist	15
Hind limb	73
Femur	22.5
Tibia	24
Longest toe	21

Remarks.—The species is most closely related to *Rana mearnsi* Stejneger from Mindanao, from which it differs in having a longer, narrower, more-flattened head, a larger tympanum of different shape, and smaller toe disks. In the shape of the tympanum it is similar to *Rana merrilli* Taylor but lacks the folds below the anus and differs in measurements. The head is more pointed, and the head and body appear flatter.

When I first examined this specimen I suspected that it was the very rare *Polypedates hecticus*. There is no distinct notch in front of the pad as is present in Philippine species, and dissection of the fourth finger failed to reveal any intercalated bone.

The species was discovered by Mr. Lyman H. Taft and Dr. F. X. Williams, and is named for the former in recognition of his kindness in collecting and presenting to me this and numerous other valuable specimens.

Micrixalus diminutiva sp. nov. Plate 1, figs. 3 and 4; Plate 2, figs. 2 and 3.

Type.—No. 1066, E. H. Taylor collection; collected near Pasananka, Zamboanga, Mindanao, November 10, 1920, by E. H. Taylor.

Description of type.—Choanæ small, widely separated, concealed under overhanging jaw; no vomerine teeth present; tongue very small, without tubercular papilla on tip, very slightly notched behind; apex of lower jaw with a single, toothlike prominence; head short, snout blunt, nostril about midway between eye and tip of snout; eye large, the diameter of orbit distinctly longer than snout; loreal region nearly perpendicular or slightly sloping; canthus rostralis rather indistinct, rounded; a very shallow depression behind nostril; tympanum with only a slight edge visible; a fold from eye running in a straight line to behind angle of mouth, then curving up to above insertion of arm; a glandular area behind angle of mouth; upper eyelid about one and one-fifth times interorbital space; skin above smooth, very minutely shagreened or corrugated; eyelid with a distinct tubercle; a dorsolateral glandular fold begins behind eye and continues more than half the length of body, more prominent anteriorly; this fold is widely separated from the supratympanic fold at its beginning; sides with numerous pustular tubercles, one above arm most prominent; belly and underside of limbs smooth; arms short, fingers small, the tips not or very slightly dilated; the palm very thick; subarticular tubercles nearest palm well defined, outer ones less strongly defined; first finger as long as second and fourth; carpal tubercles flat, indistinct; no web between fingers; indistinct tubercles on outer side of arm; toes about two-thirds webbed, the membrane reaching disk of first and second toes on the outer side and to near disk on the inner edge of fifth; a strong inner metatarsal tubercle; outer very dim, situated at the end of a flap of skin which is on the outer side of fifth toe; a slight fold on heel behind inner metatarsal tubercle; the leg brought forward tibiotarsal articulation reaches to between eye and tip of snout. (Males with two internal vocal sacs, the openings small.)

Color in life.—Above a broad chestnut brown stripe from tip of snout to anus, widening posteriorly; the rest of back and sides

pinkish lavender; two chestnut brown stripes corresponding to the dorsolateral glandular folds extend from eye to shoulder; limbs barred with chestnut brown; brown spots partially separated by yellowish spots on side of head; a yellowish streak from eye to angle of jaw; dark marking low on sides and on groins; belly flesh-colored; chin and throat with scattered brown spots; undersurface of hands and feet purplish.

Measurements of the type of Micrixalus diminutiva sp. nov.

	mm.
Snout to vent	21
Length of head	8
Width of head at tympanum	8
Length of snout	2.6
Diameter of eye	3.4
Upper lid	1.8
Interorbital space	2.2
Forelimb	12
Longest finger, to wrist	6
Hind limb	39
Tibia	11
Femur	11
Longest toe, to metatarsal tubercle	12

Variation.—Several cotypes from the same immediate locality agree with the type in general contour but some have the color pattern much less distinct; in certain specimens the broad dorsal stripe forms three branches posteriorly, one branch ending at the anus, the others being carried across the groin to the femur and tibia. In one specimen, the broad stripe is shaped like an hourglass. A single specimen taken near Abung-abung, Basilan, agrees very well, save that there is a median yellow hair line from snout to anus.

Some twenty specimens collected on Jolo Island differ markedly from the Zamboanga forms. The bodies are for the most part slenderer, the throats are very dark purple (some almost uniform) to halfway on belly. The web is more deeply excised between the toes, particularly between the fourth and fifth which are less than half webbed. The color patterns on the Jolo specimens vary considerably; at least one-fourth have the median hair line yellow in color; some specimens are brownish above, some gray to lavender. The characteristic marking of the type is present in some of the female specimens.

At first I was inclined to regard the Jolo specimens as a distinct species, but as the only tangible difference that held throughout the series was the lesser amount of webbing between the outer toes, I placed both groups under the same name.

Remarks.—This is the first record of this genus for the Philippines. I have no doubt that it is rightly associated with this group, in spite of the fact that it has not been reported from the Malay Peninsula nor from the Archipelago. When I first collected the specimens I thought them probably a new species of *Oxyglossis*. The slightly bifid tongue, the character of the toes, and the presence of the single toothlike prominence at the apex of the lower jaw preclude the possibility of this association.

Annandale [3] describes a small frog, *Micrixalus borealis*. He mentions the presence of "a jaw," which is characteristic of this species. The dorsolateral glandular fold, which is characteristic of most Indian species as well as of the species here described, is wanting in his species.

Staurois natator (Günther).

Ixalus natator GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 15, pl. 4, fig. *c*.
Staurois natator TAYLOR, Amphibians and Turtles of the Philippine Islands (1921) 78.

I collected many specimens of this species at Zamboanga and on Basilan, but found none in Jolo. Gregorio Lopez collected specimens at Cabalian, Leyte.

The Leyte specimens vary markedly in color from the others. Several of the specimens are uniform olive above; in others the color above is blackish with well-defined silver white spots. Seven among eighteen specimens have a distinct tubercle on the tongue.

The Zamboanga and the Basilan specimens are bronze to olive green, usually mottled above with silvery gray to green. The tubercle on the tongue is present in about two-thirds of the specimens, and dim or wanting in the others. The granulation on the back varies considerably. Some specimens are nearly smooth; others strongly granular, with occasional larger tubercles.

Cornufer corrugatus (Duméril).

Hylodes corrugatus DUMÉRIL, Ann. Sci. Nat. III 19 (1853) 176.
Cornufer corrugatus TAYLOR, Amphibians and Turtles of the Philippine Islands (1921) 115.
Platymantis corrugata BOULENGER, Ann. & Mag. Nat. Hist. IX 1 (1918) 373.

I collected this species on Polillo and on Mount Maquiling, Laguna Province, Luzon. I failed to obtain it in any other

[3] Rec. Ind. Mus. 8 [1] (1912) 10 (8 of author's seperate), pl. 2, fig. 2.

place. It has a wide distribution in the islands southeast of the Philippines. It probably occurs in all of the larger islands of the eastern Philippine group, since specimens have been taken in Mindanao, Negros, Luzon, and Polillo. It is very probably absent from the Sulu and the Palawan groups. The specimens vary greatly in color and markings. The regular folds on the back and the dark lores make the form easily recognizable.

Cornufer rivularis sp. nov. Plate 4, fig. 3.

Type.—No. 761, E. H. Taylor collection; collected April 25, 1920, at Balbalan, Kalinga Subprovince, northern Luzon, by E. H. Taylor.

Description of type.—(Adult female.) Choanæ rather large, widely separated; vomerine teeth in two oblique, converging series lying between and almost wholly behind choanæ, separated from the latter by a distance equal to half the length of one series and separated medially by a distance as great as the length of one series; tongue moderately wide with two small rounded horns behind and an indistinct tubercle on anterior part; head about as long as broad; canthus rostralis distinct; top of head strongly curved, longitudinally, to tip of snout; eye moderate, the diameter of orbit equal to or slightly greater than distance from eye to nostril; interorbital space at least one and one-half times the width of upper eyelid; tympanum small, indistinct, apparently covered with skin, its diameter equal to about one-third to one-half the diameter of orbit; a distinct supratympanic fold curves from eye to above insertion of arm; a slight fold curves upward across angle of mouth; head, upper eyelid, and skin on back and sides smooth with no trace of granules or tubercles; throat and chin smooth; posterior part of belly with large mosaiclike granules; area about anus granular; fingers with tips dilated into large disks, much larger than tympanum; disks on two outer fingers much larger than those on inner fingers, which appear to be opposed to the two outer; first very much smaller than second; subarticular tubercles large, distinct; three distinct carpal tubercles; tips of toes widened into distinct disks, smaller than those on outer fingers; a small but distinct web at base of toes; third and fifth toes of equal length, or the third slightly longer; inner metatarsal tubercle elongate, low, dim; outer small, rounded; subarticular tubercles moderately distinct; none or only a dim fold on outer side of fifth toe, a distinct spinelike tubercle on heel; the leg

brought forward the tibiotarsal articulation reaches to near nostril.

Color in life.—Dorsal surface, from extreme tip of snout to anus, light gray; small, scattered, deep black dots and blotches on back, with a large prominent blotch on shoulders; gray area of back edged with blackish laterally; loreal region and sides of head and body dusky; belly and throat whitish, with brown flecks on belly; groin, thighs, femur, hand, and foot yellow; upper lip with a few indistinct yellowish marks.

Measurements of the type of Cornufer rivularis sp. nov.

	mm.
Length, snout to vent	26
Width of head	10
Length of head	11.5
Length of snout	5
Diameter of orbit	3.6
Interorbital distance	3.4
Upper eyelid	2
Tympanum	1.4
Forelimb	19
Longest finger, with hand	9
Hind limb	43
Femur	13
Tibia	14
Longest toe, to metatarsal tubercle	13

Variation.—Five other specimens were taken, all more or less resembling the type in markings and color. One specimen (No. 759) had a large red blotch on the groin. When preserved the markings of most of the specimens changed. The gray area on the back disappeared, and the entire body assumed a brownish color, with two longitudinal dark markings running parallel on the back from occiput to middle of back and two short longitudinal marks on sides ending near the groin. The tubercle on the tongue is more or less distinct in all the specimens.

One of the specimens (No. 760, length 23 millimeters) is full of eggs. These are yellow and are very large, measuring from 3 to 3.5 millimeters in diameter.

The males have vocal sacs; the opening is situated near the angle of the jaws.

Remarks.—The specimens were taken in the small brook, just behind the town of Balbalan, which furnishes water to the town. They were seated on the leaves of a plant growing over the running water. Instead of jumping when I approached, they merely crouched close to the edges of the leaves in which posi-

tion they were picked up. *Cornufer cornutus* was taken in this same shrub.

The species belongs to the section of the genus characterized by the flattened fingers dilated into disks at the tips. I state above that the first and second fingers appear to oppose the other two. This is true in three of the specimens, but in the others the apparent apposition is not so plainly marked. It does not appear to be closely related to other Philippine species.

Cornufer montanus sp. nov. Plate 4, fig. 4.

Type.—No. 861, E. H. Taylor collection; collected May 31, 1920, at an elevation of about 1,500 meters on Mount Banahao, Laguna Province, Luzon, by E. H. Taylor.

Description of type.—Choanæ moderate, not concealed by overhanging jaw; two small groups of vomerine teeth lying between and behind choanæ, beginning near inner posterior edge of choanæ and converging backward, widely separated medially; distance between choanæ greater than distance between nostrils; canthus rostralis distinct; upper part of loreal region perpendicular, then sloping very obliquely to lip; tip of snout rather truncate, sloping obliquely to lip and not extending beyond lower jaw; nostril nearer tip of snout than eye; diameter of orbit equal to length of snout; upper eyelid equal to or slightly wider than interorbital area; tympanum covered with skin, dim, small, a little more than one-third the diameter of orbit, separated from orbit by a distance equal to more than half its diameter; upper eyelid with two large flattened tubercles; a pair of tubercles on back of head, and another pair on shoulders; skin on back and limbs smooth; loreal region slightly granular; a supratympanic fold begins behind eye and curves downward over upper edge of tympanum to insertion of arm; another slight fold curving up across angle of mouth, crossing lower part of tympanum; a strong tubercle on heel; chin, throat, and belly strongly granular; anal region with strong granules; no dorsolateral glandular folds; hand with three outer fingers flattened, the tips dilated into strong disks at least twice as wide as finger; subarticular tubercles strongly defined, large, rounded, and flattened; small palmar tubercles, three carpal tubercles moderately distinct, with a fourth somewhat behind these on wrist; inner finger small, not dilated at tip, and less flattened than the others; toes flattened and dilated at tips, the disks not more than one and one-half times the width of digit; subarticular tubercles large, flat, not strongly defined; a slight rudiment of web be-

tween toes, third toe longer than fifth; an inner and an outer metatarsal tubercle; no skin fold along outer toe to heel; the hind limb brought forward the tibiotarsal articulation reaches to near anterior corner of eye; opening of vocal sac near angle of mouth; tongue with two horns posteriorly and a large tubercle anteriorly.

Color in life.—Above gray-brown, variegated, with a broad median cream yellow stripe from tip of snout to anus; bars on legs dull cream to white; side and groin with large, bright, lemon yellow spots, separated by narrow lines of brown; belly and chin flesh-colored, mottled with brown; underside of limbs with large islandlike white or yellow spots; toes barred with cream; a narrow indistinct line from eye across tympanum and angle of mouth. Loreal region dark brown, mottled slightly with lighter.

Measurements of the type of Cornufer montanus sp. nov.

	mm.
Snout to vent	28.5
Length of head	12
Width of head	11.5
Upper eyelid	3
Interorbital distance	3
Eye to end of snout	5
Diameter of eye	5
Eye to nostril	4
Forelimb	18.5
Longest finger, with hand	10
Hind limb	45
Femur	12.5
Tibia	15
Longest toe, to metatarsal tubercle	12.5

Remarks.—The type was collected at an elevation of nearly 1,500 meters, on Mount Banahao, on small shrubs growing out from a perpendicular cliff. Only the type was found. This species appears to be related to *Cornufer worcesteri* and *C. guentheri*. From the former it differs in having a papilla on the tongue, the eye being larger in proportion to the length of the snout, the upper eyelid equaling the interorbital distance, the tympanum being one-third the diameter of eye, and the tibiotarsal articulation reaching only to the eye instead of to the nostril. The color and markings are essentially different. From *C. guentheri* it differs in color, in the presence of a large tubercle on the heel, and in the absence of one on the angle of the jaws. There are numerous other differences.

Cornufer subterrestris sp. nov.

Type.—No. 707, E. H. Taylor collection; collected near kilometer 101, on the Mountain Trail, Mountain Province, Luzon, April 17, 1920, by E. H. Taylor.

Description of type.—Male. Choanæ small, very far forward and near to each other, not concealed by overhanging jaw; vomerine teeth very dim, represented by a rugose area somewhat between and behind choanæ; tongue elongate, with two posterior horns, which are very narrowly separated at base, and a tubercle on the anterior part; openings to vocal sacs elongate slits near angle of jaws; top of head rather curving forward; canthus rostralis distinct; upper part of loreal region slightly oblique, lower part strongly oblique; nostrils about halfway between orbit and extreme point of snout; eye large, diameter of orbit equal to or very slightly less than length of snout; interorbital area nearly double upper eyelid; distance between nostrils much less than interorbital distance; tympanum moderately distinct, about two-fifths diameter of orbit; skin of head smooth; no tubercle on eyelid; apparently no supratympanic fold; skin on back and sides smooth (in the middle of the back the skin is puckered and drawn forming a small blind sac; this appears to be a normal condition); skin of chin and throat smooth, that on belly very indistinctly granular; area about anus very dimly granular; fingers somewhat flattened, the tips dilated into disks, those of the two outer fingers larger than those of the two inner; subarticular and carpal tubercles rather indistinct; toes slightly flattened, with very small disks; a slight web at base of toes; third toe longer than fifth; subarticular tubercles rather dim; inner metatarsal tubercle present; outer, if present, very dim.

Color in life.—Above purplish without markings on head; sides dark purplish brown with large rounding spots of cream to yellow, more prominent on groin and axilla; upper part of limbs purplish; on sides and below with large, cream-yellow, irregular spots; throat dusky; belly dusky, reticulated with cream.

Measurements of the type of Cornufer subterrestris sp. nov.

	mm.
Snout to vent	25
Length of head	11
Width of head	10.5
Snout	4.8
Diameter of orbit	4.8
Interorbital distance	4
Upper eyelid	2
Tympanum	1.9

Measurements of the type of Cornufer subterrestris sp. nov.—Continued.

	mm.
Forelimb	16
Longest finger, with hand	8
Hind limb	38
Tibia	11
Femur	12
Longest toe, to metatarsal tubercle	12

Remarks.—The type specimen has been injured by rubbing, after having been preserved, and there is some doubt as to the correctness of certain minor characters. However, the species is very distinct, and I have no hesitancy in describing it from a single specimen.

After a very heavy rain and hail storm I heard the frogs in the small gullies along the mountain trail. I endeavored to locate them by following up their thin, high-pitched voices. Although the frogs were very close to me, I could not find them. Later in the afternoon several were heard on the bank of a small mountain stream which crosses the trail near kilometer 101. The bank was covered with moss. I stood in the icy water and began to dig in the bank; after half an hour's work, realizing that I must reach camp before dark, I gave up. On starting to pick up my gun, which I had laid on a narrow ledge, I found the tiny frog sitting on my gun stock.

The species apparently belongs in the genus *Cornufer*, although I do not feel wholly certain. More material may warrant a different generic designation. The vomerine teeth are different from those of other species of *Cornufer*—in fact, I am not certain that the slightly rugose area should really be regarded as vomerine teeth.

Polypedates pardalis (Günther).

Rhacophorus pardalis GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 83.
Polypedates pardalis TAYLOR, Philip. Journ. Sci. 16 (1920) 281, pl. 4, fig. 1; pl. 6, figs. 2 and 2*a*; Amphibians and Turtles of the Philippine Islands (1921) 82, pl. 4, fig. 1; pl. 6, figs. 2 and 2*a*.

Specimens of this species were collected at Balbalan, Kalinga, northern Luzon; on Polillo Island; and at Port Holland, Basilan. Four Kalinga specimens were collected at night on April 28, from rain pools in which they were breeding. *Kaloula rigida* Taylor and *Polypedates leucomystax* (Gravenhorst) were breeding in the same pools.

When first taken, the specimens were nearly uniform yellow. Later the live specimens became reddish brown, with markings more or less distinct. The bellies were white to cream, rather than yellow. Three specimens taken in Polillo in July, 1920,

were found in the unfolding leaves of *banban* plants, at a distance of about 2 meters from the ground; two were vivid greenish yellow above and white below, and the third was bluish green, later changing to yellow. The latter when placed in alcohol became bluish, and when fixed is a dark grayish blue. At first I believed I was dealing with a new species. More material may warrant a separation.

Basilan specimens were taken at night on October 10, 1920, in an old open well where they were breeding. Both males and females were dark brown with yellow or cream spots when taken. Masses of eggs were found around the edge of the well, and on plants about the walls. The eggs are laid in masses of foam, very similar to those of *Polypedates leucomystax*. They can be easily distinguished from that species by the fact that the mass is distinctly yellow, while that of *P. leucomystax* is whitish or cream. A number of larvæ and recently transformed young were taken some time later. One of the Polillo adult specimens has a curious deformity. The fourth toe sends off two branches at the antepenultimate joint, resulting in a total of seven fingers. The accessory fingers have developed distinct disks at the tips. The subarticular tubercle of the antepenultimate joint is at one side, wholly on the web.

Polypedates linki sp. nov. Plate 3, fig. 2.

Type.—No 1703, E. H. Taylor collection; collected at Jolo, Jolo Island, November 10, 1920, by E. H. Taylor.

Description of type.—(Adult female.) Choanæ large, not or but slightly concealed by overhanging jaw; vomerine teeth in two short slender oblique series arising from near the upper anterior edge of choanæ and not extending to posterior border; the series of teeth separated by a distance nearly equal to length of one series; tongue rather small, with two posterior horns, no tubercle; snout short, rather truncate; loreal region slightly oblique, concave; canthus rostralis distinct, the edge somewhat rounded; eyes moderate, diameter of orbit equal to distance from nostril; upper eyelid equal to or slightly wider than interorbital distance; distance between nostrils less than their distance from eye and less than interorbital distance; nostril very much nearer to end of snout than eye; tympanum large, entirely distinct, its diameter about two-thirds that of orbit; a well-developed straight glandular fold from behind eye running diagonally to a point some distance behind insertion of arm; interorbital area with a broad shallow depressed area; skin of back almost wholly smooth; skin on head smooth, not involved in cranial ossifica-

tion; edges of frontoparietal bones bordering orbit slightly raised, forming an indistinct narrow crest, converging rather strongly behind; a very faint suggestion of granulation evident on eyelid, on posterior part of body, and on femur; throat smooth or minutely granular; belly and inferior and posterior aspects of femur strongly granulate; three or four granules below anus very slightly larger than others; fingers with strongly dilated tips; subarticular tubercles strong; palmar and carpal tubercles dim, irregular; only small trace of web between fingers; a slight indistinct fold on outer side of arm; tips of toes dilated into disks only a little smaller than disks on fingers; toes webbed to disks on outer side of third and inner side of fifth; web reaches penultimate subarticular tubercle on fourth; first finger about half webbed; subarticular tubercles small, but well differentiated; a well-defined inner metatarsal tubercle; outer, if present, very dim and indistinguishable; a very dim fold on outer side of fifth toe to heel; sole with fine granulation; tibiotarsal articulation reaches between eye and nostril.

Color in life.—Cream to lemon yellow above, with no traces of markings save a whitish area below eye in front of tympanum; underside cream. (Taken at night.) When preserved in formalin a few bars on the hind limb and a few dusky markings on the throat became visible; the body color became light gray to gray-brown.

Measurements of Polypedates linki sp. nov.

	No. 1703, type, ♀.	No. 1703A, ♂.
	mm.	*mm.*
Snout to vent	63	43
Length of head	23	17
Width of head	22	15
Snout	11	7.5
Diameter of eye	7	6
Upper eyelid	7	5.5
Interorbital space	6.5	5
Eye to nostril	7	5
Diameter of tympanum	5	3.8
Forelimb	39	29
Longest finger, with hand	19	14
Hind limb	100	72
Femur	35	22
Tibia	36	23
Longest toe, to metatarsal tubercle	23	18

Variation.—The type was collected while it was hopping in the streets of Jolo at night. Five specimens were taken in a small rain pool near the foot of Bud Daho, a low volcanic

crater 10 kilometers east of Jolo. These were sitting in the edge of the grass about the pool and immediately took refuge in the water. The five specimens are all males. (No females were seen in this locality.) These were gray white or cream yellow above. One specimen showed a triangular black mark in the interorbital region and a regular marking on the back. In formalin all show dim markings on limbs, and three have dim triangular markings on the head; there is only a faint suggestion of the white spot in front of the tympanum. No. 1704, taken a few kilometers south of Jolo, near Indanan, was found under the loosened bark of a tree. In life the specimen was brownish yellow, and the mark in front of the tympanum was strongly defined; there was a dim line along the upper lip with dim bronze markings on sides and throat. There is some variation in the relative size of the eye and the length of the snout. The males have no vocal sacs.

One of the specimens taken near Bud Daho was heavily infested with small yellow flukes, which were embedded in the muscles of the limbs and the head. More than fifty specimens of the fluke were taken; they measure, when preserved, 5 to 6 millimeters in length. Two more specimens of *Polypedates linki*, a young and an adult, were recently received from Jolo, collected by Capt. Francis Link.

The species is related to *Polypedates leucomystax* and *P. macrotis*, from which it differs in having a shorter hind limb and a narrower interorbital space, in color and markings, and in the fact that the skin on the head is not involved in the cranial ossification. It may also be related to *P. hecticus*, which is known from Samar, from which it differs in the absence of a strongly defined dorsolateral fold.

The type contains yellow eggs, 3 to 4 millimeters in diameter. The stomach contained a full-grown specimen of *Hemidactylus frenatus*.

Remarks.—The species is named for Capt. Francis Link, Philippine Constabulary, who accompanied me on numerous collecting trips about the island, and assisted greatly in making collections.

Polypedates appendiculatus (Günther).

Rhacophorus appendiculatus GÜNTHER, Cat. Batr. Sal. Brit. Mus. (1858) 79.

Polypedates appendiculatus TAYLOR, Philip. Journ. Sci. 16 (1920) 280, Pl. 8, figs. 2, 2*a*, and 2*b*.

Specimens of this species of *Polypedates* were collected on Polillo Island and on Basilan Island. These two localities, particularly the former, extend the known range of the species greatly. Dinagat has hitherto been the most northern locality for the eastern Philippines. The species has been reported from Borneo, Mentawei Islands, and Celebes, outside of the Philippines. The occurrence of the species in the Calamian Islands has been reported by Boettger. I rather question this locality. It will be remembered that there was some doubt regarding the type locality of *Kalophrynus acutirostris* Boettger which is reported as being "entweder von Culion oder von Samar;" it is not improbable that the record for *Polypedates appendiculatus* should be Samar, since no other collector has obtained it either in the Calamian Islands or in Palawan.

The Polillo specimen (No. 877) was captured by myself on July 18, 2 kilometers east of the town of Polillo, in the half-opened leaf of a plant known locally as banban. When taken the specimen was pure canary to lemon yellow above and cream below; no markings of any sort were in evidence. When preserved it became very light lavender above with no markings. The skin is entirely smooth. The folds on the arm and foot are very distinct as are the folds below the anus.

On Basilan the specimens of this species were usually collected at night or during showers. They were for the most part marked or strongly colored. One specimen (No. 1368) taken at Port Holland had the following markings: Above gray, with regular distinct markings on head, shoulders, and back; pupil of eye deep blue, iris copper; throat and belly cream to yellow; anterior and posterior sides of hind limbs bright orange to vermilion. Another specimen (No. 1411) was dull olive brown above; chin greenish yellow; belly flesh-colored; anal region white; sides of femur vermilion.

The vermilion marking was evident in all of the Basilan specimens. The red markings of the femur persisted long after the specimens were preserved. Some show spots of black, but most of the specimens are dull mottled lavender when preserved. Some have granules or tubercles on the back; in others the skin is smooth. None of the specimens has extensive webbing on the foot as is shown in Boulenger's figure.[4]

Most of the specimens were discovered by hearing their call at night. All seem to be males.

[4] Cat. Batr. Sal. Brit. Mus. ed. 2 (1882) 86, pl. 8, fig. 4.

Kalophrynus stellatus Stejneger.

Kalophrynus stellatus STEJNEGER, Proc. U. S. Nat. Mus. **33** (1908) 575; TAYLOR, Philip. Journ. Sci. **16** (1920) 329, pl. 9, fig. 2; Amphibians and Turtles of the Philippine Islands (1921) 130.

I obtained a splendid series of this species at Port Holland, Basilan, between October 8 and 14. The animals were found breeding in an old watering trough near the forest, and in pools of stagnant water held by gnarled tree roots in the same immediate locality.

A large female with a male clasped on her back was first discovered hopping toward the trough about 11 o'clock in the morning of October 8. I watched them enter the water and begin swimming about. The male kept holding on to the female with his arms, leaving his legs stretched out behind. After about five minutes the female ducked her head and anterior part of the body under the water, exposing the posterior part, and the anal opening. The male slid back until his head was out of the water, and clasping the female along the side of the belly placed his legs in such a position about the anus that a small cup was formed, into which the female extruded a small group of eggs, and the male, the sperm. Thus the eggs and sperm came into contact above the water. The female then righted herself, and the male pushed forward again. They swam a short distance, and the same process was repeated. This was done some twelve or thirteen times, an interval of one or two minutes elapsing between each extrusion.

The extruded eggs were surrounded by a gelatinous disk which encircled the sphere in a plane, and held the eggs from rotating; the disk has a circular depression between the egg and the outer rim. This disk gradually widens after extrusion until it becomes about 6 millimeters in diameter. From nine to seventeen eggs are extruded at one time. They could be counted floating together, each group separated from that preceding it. After completing the deposition, the female gave a slight kick and the male, apparently recognizing the signal, unclasped the female, and dived under the water. He reappeared a minute later, crawled over the edge of the tank, hopped to the ground, and started away. The female soon left the tank. Both were captured.

I watched more than ten pairs approach the tank, enter, and go through the same egg-laying process. All were captured after they left the tank.

The ground color on the back varied greatly. There were various shades of brown, red-brown, maroon, clay white, cream yellow, orange, lavender, and purple. Practically no two specimens could be found of exactly the same color. The characteristic markings on the back (two irregular lines crossing on the shoulders, continued brokenly across the folded leg, and large round black spots on the groins usually concealed by the femur when the animal is seated) were invariably present in life. Many, if not all of the males, had deep brown markings on the chin and the throat, and a few had the belly also spotted with dusky. Several specimens had a few scattered, irregular, deep black spots on the back. The stellate yellow dots on sides and belly are present in a large number of the specimens.

A single specimen, almost red above, was taken at Abungabung, on the southern coast.

Bufo philippinicus Boulenger.

Bufo philippinicus BOULENGER, Ann. & Mag. Nat. Hist. V 19 (1887) 348, pl. 10, fig. 5; TAYLOR, Philip. Journ. Sci. 16 (1920) 344; Amphibians and Turtles of the Philippine Islands (1921) 145.

A splendid series of this species was recently obtained by Gregorio Lopez, at Coron, Busuanga. The series consists of numerous adult, half-grown, and young specimens.

Boulenger established the species on an adult female specimen collected in Palawan by Everett. The species has since been collected at various places in Palawan, Balabac, and Busuanga. Various reports of a large toad occurring in Mindanao have reached me, but I cannot state without doubt the origin of any of the specimens I have examined that are supposed to have come from Mindanao. No species of *Bufo*, as far as I know, has ever been reported authentically from Luzon or from the Visayan Islands. Three small species occur in Mindanao.

The largest specimen, an adult female, measures 92 millimeters from snout to vent. The largest male examined measures 73 millimeters.

The specimens at hand were collected in the daytime by schoolboys. More than twenty specimens were found.

Megalophrys stejnegeri Taylor.

Megalophrys stejnegeri TAYLOR, Philip. Journ. Sci. 16 (1920) 347, pl. 10, figs. 1 and 1*a*; Amphibians and Turtles of the Philippine Islands (1921) 148, pl. 10, figs. 1 and 1*a*.

Three specimens of this species were obtained; one from northern Surigao, collected and presented to me by Charles

Fuller Baker; one from Cabalian, southern Leyte, collected by Gregorio Lopez; the third from Zamboanga, Zamboanga, collected by me. The specimens agree with my figure and description.[5] The Leyte specimen is a male, with the openings of the vocal sacs distinct. The tuberculation on the sides of the three specimens is somewhat more pronounced than in the type. I find no trace of vomerine teeth in any of the specimens.

LIZARDS

Lepidodactylus divergens Taylor.

Lepidodactylus divergens TAYLOR, Philip. Journ. Sci. § D 13 (1918) 242; Lizards of the Philippine Islands (1922) 71.

Visits were made to Great Govenen and Little Govenen, two small islands directly in front of Port Holland, Basilan. Great Govenen, the type locality of this *Lepidodactylus*, was visited twice previously, but in the large series of specimens taken no male was found. The collections made there on October 9, 1920, contained fourteen specimens from the larger island, and twenty-three from the smaller one. One male was found in the first lot; two in the second. The number of preanal pores agrees very well with counts recorded for the preanal scales in the females.[6]

Preanal pores in males of Lepidodactylus divergens Taylor.

No.	Locality.	Preanal pores.
1300	Great Govenen	15-15
1236	Little Govenen	16-18
1284A	do	15-16

The species could not be found along the Basilan coast although great effort was made to find it. No specimen of *Lepidodactylus woodfordi* was found on the islands on this visit. One specimen was found during a previous visit.

Lepidodactylus aureolineatus Taylor.

Lepidodactylus aureolineatus TAYLOR, Philip. Journ. Sci. § D 10 (1915) 97; Lizards of the Philippine Islands (1922) 83.

I collected a single specimen of this species at Abung-abung in southern Basilan. It is an adult male and agrees very well with the type. There are nineteen preanal-femoral pores on each side, which is the exact count in the type; thirteen or fourteen

[5] Loc. cit.

[6] Taylor loc. cit.

upper labials, twelve lower. The last three upper labials are very small and indistinct.

The specimen was collected under loose bark on a large forest tree. No other specimen was seen. When first collected the color above was dark olive, the belly yellow. A bright golden, black-edged line, extending from the eye to above the auricular opening, is dimly evident in the loreal region. No marking was discernible on the back. The tail is colored like the body, with a few indistinct darker marks.

Sphenomorphus luzonensis (Boulenger).

Lygosoma luzonense BOULENGER, Proc. Zool. Soc. London (1894) 733, pl. 49, fig. 2; TAYLOR, Lizards of the Philippine Islands (1922) 175, pl. 15, fig. 1.

A good series of this small *Sphenomorphus* was collected along the small brooks in the neighborhood of Balbalan, Kalinga.

The specimens were always found in the immediate vicinity of water, and when disturbed they would take refuge by diving in the water and concealing themselves under rocks or débris at the bottom. Several of the specimens are females containing partially developed eggs.

Color in life.—No. 734, the largest specimen taken (101 millimeters), is brown above; median line deep chocolate with ill-defined bluish white spots; a broad chocolate lateral stripe, edged above and below with rows of black and bluish white, ill-defined spots; sides, below the chocolate stripe, salmon to orange with white flecks; backward from the arms the breast and belly are deep orange, more pronounced posteriorly; basal part of tail deep orange, verging into flesh color toward tip. Chin, flesh color to white, flecked with darker. Most of the specimens have the same color and marking. The orange on the belly is usually well pronounced in adults.

Sphenomorphus beyeri sp. nov.

Type.—No. 17, E. H. Taylor collection; collected May 31, 1920, on Mount Banahao, Laguna Province, Luzon, elevation about 1,500 meters, by E. H. Taylor.

Description of type.—Rostral large, clearly visible above, forming a strongly curved suture with the frontonasal; latter wider than long, very narrow laterally, touching first superior loreal, forming a short curved suture with the frontal; prefrontals moderately large, separated, touching two superior loreals, first superciliary, and first supraocular; frontal generally triangular, much longer than wide, very strongly narrowed behind to a point, leaving interorbital region extremely narrow; frontoparie-

tal single, slightly longer and larger than frontal, broader than long; interparietal small, considerably longer than wide; parietals forming a suture behind interparietal; nasal large, single, the nostril pierced near center; nasal followed by two pairs of superimposed loreals, the two upper larger than the lower; three large superimposed preoculars, the median most anterior; orbit separated from labials by two or three rows of small scales, the two above the fourth labial rather enlarged; ten superciliaries, the anterior very large, comparatively; four supraoculars, the anterior triangular, the second widest; last supraocular followed by four curved rows of very small scales, each row with three scales, separating orbit from the very large superior temporal; seven upper labials; four elongate superior temporals lying posterior to one another, the one touching parietal largest; lower temporals small, irregular, numerous; six or seven lower labials; mental moderate, extending back to middle of first upper labial; a very large azygous postmental, followed by two pairs of chin shields, the second small, widely separated; ear opening large, oval, the tympanum not deeply sunk; no anterior lobules; scales in forty rows around the body, the rows on sides regularly longitudinal; two strongly enlarged preanal scales; limbs moderate, the adpressed hind limb reaches to near elbow of the adpressed forelimb; eleven lamellæ under longest finger; seventeen under longest toe.

Color in life.—Head purplish to lavender; body generally lavender-brown, mottled with darker brown; a median indistinct series of blackish spots; lateral, irregular, dark brown lines with light yellow-brown, rounded markings above and below; above the arm and on the neck the lateral dark mark widens, takes a downward course, and is very distinct; the yellow-brown markings below are very distinct; labials purplish, each with a rounded light spot; chin, throat, and sides of neck flesh color, mottled and reticulated with lavender; belly yellow to flesh color; underside of arm yellow; posterior part of femur with round yellow spots and a dark mark on outer side of leg; dark markings above insertion of legs very distinct; tail missing.

Measurements of the type of Sphenomorphus beyeri sp. nov.

	mm.
Total length	46
Snout to vent	42
Width of head	6.5
Length of head	11
Forelimb	12
Hind limb	17
Width of body	7

Remarks.—The specimen was captured on a ledge, on Mount Banahao. The tail was inadvertently broken, and it wriggled off the ledge to an inaccessible point below. The species, judging by the superimposed loreals, is related to *Sphenomorphus curtirostris* Taylor. It differs in the arrangement of the scales in front of and below the eye, and in the nature of the temporals. The colors and markings are different, and several other differences are evident. The new species is represented by the type only, and it is probably very rare. The species is named for Dr. H. Otley Beyer, associate professor of ethnology and anthropology of the University of the Philippines, who has assisted me in making collections.

Tropidophorus stejnegeri sp. nov. Plate 4, fig. 1.

Type.—No. 1538, E. H. Taylor collection; collected at Abungabung, Basilan, October 22, 1920, by E. H. Taylor.

Description of type.—Rostral nearly perpendicular, not bent back over snout, wider than high, lowest medially; frontonasal much broader than long, touching one loreal laterally; prefrontals much smaller than frontonasal, in contact medially, touching both loreals, and in contact with first supraocular; frontal extending anteriorly to edge of orbit, posteriorly to middle of eye, in contact with three supraoculars; four supraoculars, the third as wide as or wider than second; last supraocular followed by a single small scale; frontoparietals small, forming a suture much more than half their length; interparietal two and one-half times as long as broad; parietals separated, nearly as broad as long, very irregularly shaped, bordered posteriorly by an elongate temporal which is separated from its fellow by four small scales; nostril in single nasal; two loreals, second nearly double the size of first, separated from labials by a narrow intercalated scale, followed by three pre- or suboculars; seven superciliaries; eight upper labials, the first four small, subequal, followed by the fifth which is greatly enlarged; sixth smaller than fifth but larger than seventh; eighth smaller still; a strong diagonal groove in front of eye and another, less pronounced, above anterior labials; temporals numerous, irregular, those above seventh labial rather elongate; eye moderate, the diameter of orbit equaling distance to end of snout; snout short, the outline of head above in profile a strong, rather regular curve; tympanum large, not deeply sunk, much higher than wide, its distance from orbit little greater than orbit or length of snout; five lower labials, the three anterior elongate, the last two very much smaller, mental very slightly wider than rostral, not as

deep; a large azygous postmental; latter followed by three pairs of chin shields, the two anterior in contact medially, the second pair much larger than the first pair, third pair separated by three scales; scales on back strongly keeled, the keels forming longitudinal lines on the six median rows; lateral keels form irregular diagonal lines; scales on belly not keeled; a single large preanal; tail with scales strongly keeled above; median scale row under tail somewhat widened and not keeled; limbs well developed, the adpressed hind limb reaching the elbow of the adpressed forelimb; seventeen lamellæ under fourth finger, twenty-six or twenty-seven under longest toe; tip of tail regenerated.

Color in life.—Above brown, the body traversed by seven broad, brick-red, irregular blotches, separated by a distance less than their width; sides variegated brown with scattered dots of cream yellow; belly yellow; indistinct spots on throat greenish white; a few yellow dots on labials and temporals; a deep brown spot back of eyes; base of tail below yellow; remaining part mottled gray and yellow; tympanum yellowish.

Measurements of the type of Tropidophorus stejnegeri sp. nov.

	mm.
Total length	185
Snout to vent	93
Tail (partly regenerated)	92
Axilla to groin	48
Forelimb	28
Snout to forelimb	32
Hind limb	41
Orbit to end of snout	6.5
Tympanum to end of snout	18
Width of head, at posterior edge of orbit	13
Greatest width of head	15
Length of head	20

Variation.—There are nine cotypes in the collection, and they differ but little from the type. In two specimens from Zamboanga there are but two supraoculars in contact with the frontal; the Zamboanga specimens have the bars on the back orange and narrower than the interspace separating them; there are twenty-three and twenty-one lamellæ under the toes of the two specimens. Only one specimen, an adult male, from Basilan (No. 1529), has the chin and throat rather purplish (in all others the throat is light with dusky powdering). The belly is yellow. In this specimen the bars on the back are narrow and less prominent than in the type.

Remarks.—This species was found on the Zamboanga Peninsula and in southern Basilan. In both localities *Tropidophorus*

rivularis Taylor was also taken. The two forms are undoubtedly closely related, and many of the actual differences can scarcely be described. The differences in color are strongly marked, particularly the orange or red bars on the back, and the yellow belly. *Tropidophorus rivularis* is usually mottled gray and brown above with indistinct darker bands, the belly red-orange, the throat deep black. The width of the head is greater in this new species as are also the width of the chin shields and the distance between the angle of the jaws; the count of lamellæ under the longest toe is greater. There are only four instead of five labials in front of the large subocular labial. *Tropidophorus rivularis* was never found save along streams and brooks; on the other hand, *T. stejnegeri* was found on spurs of mountains in dry situations, never near water.

Stejneger has described *Tropidophorus misaminius* from northern Mindanao. It is, however, more closely related to *T. rivularis,* since it has the five labials preceding the subocular labials. He states that the keeled scales form eight straight longitudinal rows in his species; in *T. stejnegeri* there are but six.

The species is named for Dr. Leonhard Stejneger, the eminent herpetologist of the United States National Museum, Washington, D. C.

Brachymeles gracilis (Fischer).

Eumeces (*Riopa*) *gracilis* FISCHER, Jahrb. wiss. Anst. Hamburg (1885) 11, 85, pl. 3, fig. 1.
Brachymeles suluensis TAYLOR, Philip. Journ. Sci. § D 13 (1918) 254.
Brachymeles gracilis TAYLOR, Lizards of the Philippine Islands (1922) 245, 246.

At the time I was preparing my paper on the genus *Brachymeles*[7] I did not have at hand Fischer's original description, but depended on Boulenger's Catalogue[8] for my identifications. I have since obtained a photographic copy of Fischer's paper and find that the species I described as *Brachymeles suluensis* is *B. gracilis* (Fischer) but not *B. gracilis* Boulenger, an entirely different species, which I have named *B. boulengeri.*

Brachymeles gracilis (Fischer) is characterized by the small head, elongate body, and the great distance between the limbs, which are much reduced. The similarity between the head scales of this and those of various other species of the genus is very striking.

[7] Philip. Journ. Sci. § D 12 (1917) 267–279.
[8] Cat. Liz. Brit. Mus. 3 (1887) 386–388.

Fischer's figure of the type of *Brachymeles gracilis* is drawn × 4, while that of *B. schadenbergi* is × 2—a point which I at first overlooked; I suspect others have done likewise. In the descriptions, Fischer fails to give head measurements for either species. There are specimens in my collection of both *B. schadenbergi* and *B. boulengeri* whose head scales are identical with those as shown in Fischer's drawing of *B. gracilis;* there are young specimens of *B. boulengeri* which approach the measurements given for *B. gracilis* (Fischer), but the limbs are invariably longer in specimens of equal snout-to-vent measurements, and are contained in the axilla-to-groin distance a fewer number of times than is the case in *B. gracilis* (Fischer).

Three specimens of this rare species were found on Basilan; two near Isabela, in the western part, and one at Abung-abung, on the southern coast. The type specimen of *B. suluensis* came from Bubuan, an island a short distance southwest of Basilan. There are two or three specimens of *Brachymeles* in the United States National Museum that I believe belong to this species. They were taken in Cotabato Province, Mindanao. I am indebted to Dr. Leonhard Stejneger for permission to examine these specimens. It was Doctor Stejneger who first suggested to me that *B. gracilis* (Fischer) and *B. suluensis* Taylor might be identical.

Measurements of Brachymeles gracilis (Fischer).

	No. 1172.	No. 1173.	No. 1520.	Type of *B. gracilis.*	Type of *B. suluensis.*
	mm.	*mm.*	*mm.*	*mm.*	*mm.*
Total length	93	[a]111	132	----------	117
Snout to vent	49	71	66	67	81
Snout to forelimb	15	17.5	18	18	19
Axilla to groin	31	50.5	46	45	55
Width of head	6	7.5	7	?	7
Forelimb	5.5	6	6	6	6
Hind limb	8	11	11.5	12	[b]11-13

[a] Tip of tail regenerated.

[b] The type has one hind limb measuring 11 millimeters, the other 13 millimeters.

Remarks.—No. 1172 agrees with the type in the scalation of the head. However, it has twenty-six instead of twenty-four scale rows around the body. The length of the leg is contained in axilla-to-groin distance approximately four times.

No. 1173 agrees with the type in scalation, save that the frontal and frontonasal are more broadly in contact. The postparietal body scales on the left side are fused, forming an

elongate nuchal. The length of the leg is contained in the axilla-to-groin distance four and six-tenths times. Scales in twenty-four rows around body.

No. 1520, collected at Abung-abung, differs from the type in having the parietal broken into two scales, as have certain specimens of *Brachymeles vermis* Taylor and *Sphenomorphus biparietalis* Taylor, both from the Sulu region. The first pair of chin shields is separated by a small single shield. Scales in twenty-four rows around body.

This species probably does not attain as large a size as the other pentadactyl species of the genus. It is a burrowing form and is usually found under logs or stones. The lizards of this species move with great rapidity. It is difficult to grasp them because of their extremely smooth scales.

Brachymeles schadenbergi (Fischer).

Eumeces (*Riopa*) *schadenbergi* FISCHER, Jahrb. wiss. Anst. Hamburg 2 (1885) 87, pl. 3, fig. 2.

Brachymeles schadenbergi TAYLOR, Philip. Journ. Sci. § D 12 (1917) 268; Lizards of the Philippine Islands (1922) 249.

Twenty-one specimens of this species were taken at Zamboanga, Basilan, and Jolo. They agree very well in color and markings. A single specimen was collected in southern Leyte, by Gregorio Lopez.

The head scales are variable. Thus, of the twenty-two specimens, twenty-one have the supranasals in contact and one has them separated. In seventeen specimens the parietals form no suture; in five specimens they do. Seven specimens have the fourth labial entering the orbit; fifteen, the fourth and fifth. The character of the chin shields is apparently invariable, save in one Jolo specimen, which has the second pair wider than the first pair.

Brachymeles vermis Taylor.

Brachymeles vermis TAYLOR, Philip. Journ. Sci. § D 13 (1918) 255, fig. 10; Lizards of the Philippine Islands (1922) 258, fig. 53.

Eight specimens of this small wormlike form were collected on the Government cattle ranch near the central part of Jolo Island. They were found under leaves and trash along a small stream.

All the specimens agree in the arrangement of the chin shields; that is, having the first pair separated and the second pair wider than the first pair, separated by a single scale. All have the postmental in contact with a single labial.

In the conformation of the head scales they agree in general

with the type. The nasals are broadly separated in the eight specimens; the prefrontals are separated in seven, in contact in one; the frontoparietals are separated in the eight specimens, the parietals separated in seven, and forming a suture in one. Small nuchals are present in all the specimens. In a single specimen, the parietals are broken as shown in the drawing of a cotype.[9]

Dibamus argenteus Taylor. Plate 4, fig. 2.

Dibamus argenteus TAYLOR, Philip. Journ. Sci. § D 10 (1915) 107, pl. 1, figs. 11 and 12; Lizards of the Philippine Islands (1922) 261.

Several specimens belonging to this species were collected on Basilan at Port Holland. Specimens were found under rotting logs in a cut-over area. All of the specimens show the irregular silver blotches on the body. I have already reported, in my work on the lizards of the Philippine Islands, the Negros and Papahag specimens that are listed in the table.

Measurements and scale counts of Dibamus argenteus Taylor.

No.	Locality.	Collector.	Sex.	Length	Tail.	Scale rows.	Upper labials.	Scales bordering interparietal.	Length of leg.
				mm.	*mm.*				*mm.*
1216	Port Holland, Basilan.	E. H. Taylor	♀	132	19.5	22	1	5	----
1219	---do	---do	♀	126	18.5	22	1	6	----
1220	---do	---do	♂	88	13.0	22	1	6	2
1221	---do	---do	♂	123	19.0	22	1	6	3.6
1258	---do	---do	♂	122	19.5	22	1	5	4.0
L341	Negros	---do	♀	154	23.0	22	1	7	----
L257	Papahag Island, Sulu.	---do	♂	120	(?)	22	1	7	3.5

The limbs of this species appear to be larger and better developed than in *Dibamus novae-guineae* Duméril and Bibron. In Boulenger's illustration the limbs appear to be covered [10] with one large terminal scale and a single pair of scales above or, at most, three scales. In my specimens the limb has a large, rather pointed, terminal scale with three or four pairs of smaller scales; the preanals, too, are different, consisting of two elongate scales separated by two or three scales, the tips of these overlying a sharply pointed scale which lies directly on the edge of the anus. In the females the arrangement of the preanals is

[9] Taylor, loc cit., fig. 10*d*.

[10] Fauna Malay Peninsula, Rept. & Batr. (1912) figs. 26 A and B.

also different. The tail length of this species is contained in the body length an average of six and six-tenths times.

SNAKES

Natrix barbouri sp. nov.

Tropidonotus crebripunctatus BOULENGER (non Wiegmann), Cat. Snakes Brit. Mus. 1 (1893) 262.

Natrix crebripunctata TAYLOR, Snakes of the Philippine Islands (1922) 91.

Type.—No. 939, E. H. Taylor collection; collected at Balbalan, Kalinga, Luzon, April 26, 1920, by E. H. Taylor.

Description of type.—(Adult male.) Rostral much broader than high, slightly visible above; internasals longer than broad, longer than prefrontals; latter broader than long, much broader than internasal; frontal bell-shaped, the anterior edge nearly a straight transverse line; length of frontal equal to or slightly less than supraocular, sightly longer than its distance from end of snout; supraoculars elongate, slender, at least two and one-half times as long as broad; parietals only very slightly longer than frontal, the width equal to three-fourths the length; nasal divided, anterior part lower and longer than posterior part; loreal nearly square, much lower than nasal; two preoculars, the upper broader than the lower (three on right side); eye large, its diameter equal to its distance from anterior edge of anterior nasal scale; four postoculars; two anterior temporals, the lower much the larger, touching two postoculars; three equal-sized posterior temporals; nine upper labials, the fourth, fifth, and sixth entering orbit; ten lower labials, five touching anterior chin shields; mental broadly triangular, much wider than deep, not as wide as rostral; anterior chin shields forming a suture their entire length, not three-fourths as long as second pair, which are separated their entire length; scales in 19 rows, all strongly keeled, with apical pits; ventrals, 169; anal, divided; subcaudals, 107; tail long, slender, ending in a sharp point.

Color in life.—Gray above with transverse indistinct bands of black, broken laterally by yellowish spots; head olive without markings; neck dark without a yellow spot; upper labials yellow, edged with black above and a small spot on each of the first three labials; lower labials, chin, and throat white; a row of black dots on outer edge of ventrals strongly defined to tip of tail; outer edges of ventrals marked with gray on anterior part of belly; on latter half the entire belly also gray; under tail gray with edges of subcaudals yellowish.

Measurements of the type and the cotype of Natrix barbouri sp. nov.

	Type, ♂.	Cotype, ♀, No. 836.
	mm.	*mm.*
Total length	803	820
Snout to event	553	560
Tail	250	260
Width of head	11.5	13
Length of head	20	20
Diameter of eye	6	6
Eye to end of snout	6.4	6.3

Remarks.—In a previous publication [11] I stated in a footnote: "I strongly suspect that *N. crebripunctata* Wiegmann is indeed *N. spilogaster*. I believe further that Boulenger's species of this name is a distinct species." After obtaining a copy of Wiegmann's type description, and comparing it with young and half-grown specimens of *Natrix spilogaster* (Boie) from Manila, and after obtaining specimens of a *Natrix* which is undoubtedly Boulenger's *Tropidonotus crebripunctatus* and comparing these with Wiegmann's type description, I have no hesitancy in placing *Tropidonotus crebripunctatus* of Wiegmann as a synonym of *Natrix spilogaster* (Boie) and making a new species of the *Natrix* I have found, and which appears to be the same as that which Boulenger calls *T. crebripunctatus*.

Variation.—There are only two specimens in my collection and a very young one in the collection of the College of Agriculture at Los Baños that I believe belong to this species.

The cotype is likewise from Balbalan, Kalinga. It differs somewhat in scale counts from the type, as follows: Ventrals, 163; subcaudals (tip of tail missing), 95; preoculars, 3; postoculars, 2 on right, 3 on left side. In other respects the specimen agrees with the type in scalation.

The scale counts for the College of Agriculture specimen are: Ventrals, 160; subcaudals, 100; preoculars, 2; postoculars, 3; temporals, 2+2 and 2+3. It likewise agrees with the type save that the head is proportionately larger, as is natural in very young specimens.

In color the cotype differs from the type in having a very narrow yellow line on the median dorsal surface, broken by narrow black spots less than half the length of the intervening yellow. This continues some distance on the anterior part of the body. The entire latter half of the belly is gray, as well as

[11] Snakes of the Philippine Islands (1922) 92.

the subcaudal area. This vertebral stripe is mentioned in Boulenger's description [12] as being present.

In comparing these specimens with Wiegmann's description I find that none of the three specimens has the white nuchal spot ("der Nacken dunkler mit einem weissen Fleck"), which is invariably present in *Natrix spilogaster;* the two small spots on the parietal scales are wanting ("die beiden Punkte der Occipitalschilder, die auch bei andern Kielnatter-Arten in Jugendalter vorkommen"), and there is only a single irregular row of black dots on the outer edge of the ventrals instead of innumerable black dots arranged in transverse rows as is true in *Natrix spilogaster.* ("Die Bauchseite ebenfalls weisslich, aber mit unzähligen schwarzen Punkten bedeckt, die auf den einzelnen Bauchschildern in Querreihen zu 6–10 stehen".) The ventral and subcaudal counts of Wiegmann's specimen (148 and 96) are well within the range for *N. spilogaster,* but much lower than in the species described, in which they are 163 to 169 for ventrals and 100 to 107 for subcaudals.

The species is named for Dr. Thomas Barbour, the eminent herpetologist of the Museum of Comparative Zoölogy at Harvard College, Cambridge, Mass.

Natrix lineata (Peters).

Tropidonotus lineatus PETERS, Mon. Berl. Ak. (1861) 686.
Natrix lineata TAYLOR, Snakes of the Philippine Islands (1922) 92.

I collected three specimens of this snake along Tumugao River, Zamboanga, Mindanao, and seven specimens on Basilan, at Port Holland and Abung-abung. In general they differ from specimens collected in Agusan, Mindanao, in color and markings. Most of the Agusan specimens are dull black above with no markings distinguishable save in very young specimens. In all ten specimens the color is light olive above, with a regular network of black markings and an indistinct series of yellowish dots on the sides. The ventrals and subcaudals have a large dusky area near the middle. The head is deep brown. The strongly defined yellow labial line is present in all the specimens. All of them show a dark nuchal band with a light, irregular, nuchal spot.

No. 1403, the largest specimen collected, was found at night near an old unused well where *Polypedates pardalis* were breeding. In life the colors were as follows: Top of head and anterior part of body reddish brown, gradually becoming olive on the

[12] Loc. cit.

posterior part of body and tail; line on lip brownish white; chin and throat white; neck spot white; belly with dirty olive markings; outer edges of ventrals pinkish. Most of the specimens were taken under rocks along small rivers. The known ventral range of the species is 132 to 142; the subcaudal, 61 to 73.

Measurements and scale counts of Natrix lineata (Peters).

No.	Locality.	Collector.	Age or sex.	Length.	Tail.	Ventrals.	Subcaudals.	Anals.	Preoculars.	Postoculars.	Upper labials.	Lower labials.	Labials enter eye.	Labials touch chin shields.	Temporal.
				mm.	*mm.*										
1015	Zamboanga.	E. H. Taylor.	♂	463	120	139	73	2	2	3	8	10	3, 4, 5	5	1+3
1046	----do	----do	♂	412	107	136	68	2	2	3	8	10	3, 4, 5	5	1+3
1016	----do	----do	♂	305	73	137	68	2	2	3	8	10	3, 4, 5; 4, 5	5	-------
1403	Port Holland, Basilan.	----do	♀	598	140	132	61	2	1-2	3	8	9-10	3, 4, 5	4-5	1+3
1480	Abungabung, Basilan.	----do	yg	266	62	134	64	2	2	3	8	10	3, 4, 5	4-5	1+3
1481	----do	----do	♀	430	105	136	64	2	1	3	8	10	4, 5	5	1+3
1590A	----do	----do	♂	550	140	133	68	2	2	3	8	10	3, 4, 5; 4, 5	5	1+3
1590B	----do	----do	yg	260	57	133	62	2	1-2	3	8	10	3, 4, 5	5	1+3
1590C	----do	----do	yg	253	60	132	67	2	3-2	3	8	10	3, 4, 5	5	1+3
1590D	----do	----do	♀	463	120	132	69	2	2	3	8	10	3, 4, 5	5	1+3

Natrix dendrophiops (Günther).

Tropidonotus dendrophiops GÜNTHER, Ann. & Mag. Nat. Hist. V 11 (1883) 136, fig.

Natrix dendrophiops dendrophiops TAYLOR, Snakes of the Philippine Islands (1922) 95.

One specimen of this rare species was collected at Port Holland, Basilan. Its presence was discovered by hearing the cry of a frog which it had just caught and was beginning to eat. It was the only specimen seen. *Natrix lineata* (Peters) and *Natrix auriculata* (Günther) were taken in the same locality.

Color in life.—Head and anterior fifth of body olive to olive brown, gradually more brownish on the second fifth; latter three-fifths of body olive to dull olive brown. On the second fifth distinctly maroon to red-brown on sides, more pronounced

on the edges of the ventrals; the yellow spots in the black cross-bands are strongly pronounced, continuing some distance on the tail, less distinct on the neck. No spots on the parietals and no nuchal spot; black marks on lower labials at the sutures; spots on the first three upper labials and on the sixth.

Scalation.—Nine upper labials, ten lower labials; one preocular on left, two on right; three postoculars; temporals two, followed by three, the lower anterior very large; scales in seventeen rows; tip of tail missing; anal, double; ventrals, 168. This is the first record of the snake from Basilan.

This species differs from *Natrix barbouri* sp. nov. in the larger eye and the dentition.

Oxyrhabdium modestum (Duméril and Bibron).

Stenognathus modestus DUMÉRIL and BIBRON, Erp. Gén. 7 (1854) 504.
Oxyrhabdium modestum TAYLOR, Snakes of the Philippine Islands (1922) 100.

I collected three specimens of this snake in 1920; two near Zamboanga, and one on Basilan Island. Gregorio Lopez collected a specimen at Cabalian, Leyte. The specimens from Zamboanga and Basilan have rather shorter, wider heads than the Leyte specimen has, and a higher average of ventrals, the counts for the two Zamboanga specimens being much higher than any recorded counts. The known range is: Ventrals, 162 to 189; subcaudals, 49 to 66. The chin shields of the Leyte specimen are longer and narrower than those of the other specimens. The Zamboanga specimens were found in a rotted tree stump. The Basilan specimen collected at Abung-abung was found at the base of a small palm tree.

Measurements and scale counts of Oxyrhabdium modestum (Duméril and Bibron).

No.	Locality.	Collector.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	Upper labials.	Lower labials.	Labials enter eye.	Labials touch chin shields.	Postoculars.
				mm.	*mm.*							
1017	Zamboanga.	E.H. Taylor.	♀	445	75	189	62	8	7	5-6	5	2
1047	do	do	♀	482	80	186	57	7	7-6	4-5	4-5	2
1593	Basilan	do	♀	340	62	174	58	8	6	5-6	4	2
0000	Leyte	Gregorio Lopez.	♂	500	98	165	57	9-8	7	5:6:7 5:6	------	------

Oxyrhabdium leporinum (Günther).

Rhabdosoma leporinum part., GÜNTHER, Cat. Col. Snakes Brit. Mus. (1858) 12.

Oxyrhabdium leporinum TAYLOR, Snakes of the Philippine Islands (1922) 103.

Three specimens are in the collection, one collected by myself along the mountain trail near Haight's (Pauai); the other two were collected by Father F. Sanchez, S. J., at Baguio, and presented to me. No. 697 when taken was light olive to yellow-green above, dusky below. This specimen differs from the other two in having the chin shields together, forming a circle. The shields are shorter and wider than normal. No. 384 is a young specimen with a broad light area behind the eye which narrows above and crosses the occiput on the posterior edges of the parietals. The body is crossed by thirty-seven narrow yellow lines not wider than a single scale.

Measurements and scale counts of Oxyrhabdium leporinum (Günther).

No.	Locality.	Collector.	Age or sex.	Length.	Tail.	Ventrals.	Subcaudals.	Upper labials.	Lower labials.	Labials enter eye.	Labials touch chin shields.	Scale rows.	Temporals.
				mm.	*mm.*								
697	Mountain trail, Benguet.	E. H. Taylor	♂	640	92	175	42	7	6	4, 5	4	15	1+2
547	Baguio, Benguet.	Father Sanchez.	♀	540	90	169	49	7	6	4, 5	4	15	2+2 1+2
384	------do------	------do------	yg	235	36	167	45	7	6	4, 5	4	15	1+2

Zaocys luzonensis Günther.

Zaocys luzonensis GÜNTHER, Proc. Zool. Soc. London (1873) 169; TAYLOR, Snakes of the Philippine Islands (1922) 135, pl. 12, figs. 1 and 3; pl. 13, figs. 1 and 2.

Three specimens of this rare snake were obtained; one in northern Kalinga at Balbalan, one in Polillo Island, and the third was presented to me by Mr. O. W. Pflueger of the School of Forestry at Los Baños. The Polillo specimen is very young and differs so markedly in coloration that I supected when I collected the specimen that it was new.

Variation.—The Kalinga specimen is brown above on the anterior part of the body, each scale with a black area or edged with black. The middle third of the body is lighter

brown, the scales more deeply edged with black; in fact, the black is predominant. The latter third has the black still more prominent, with groups of flowerlike yellow-brown spots on each side of the median line of the back. The tail is entirely black save on the basal third, which has a few spots arranged in two rows on the dorsal surface. Chin and anterior third

Measurements and scale counts of Zaocys luzonensis Günther.

No.	Locality.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	Anals.	Upper labials.	Lower labials.	Labials touch chin shields.	Preoculars.	Postoculars.	Temporals.	Scale rows.
			mm.	*mm.*										
811	Kalinga	♂	1,640	480	192	122	2	9-8	9	5	1-2	3	2+2	14
								8					2+2+1 / 1	
295	Polillo	------	508	138	202	124	2	8	9	5	2	2	2+2	14
000	Los Baños	------	2,060	580	201	126	2	8	8-9	5	3-2	2	2+2	14

of belly flesh color; median third flesh color anteriorly, each ventral edged with black and growing heavier posteriorly; posterior third of belly and under tail deep black. The snout is light brown; the top of the head black-brown with no markings on labials.

The specimen from Los Baños differs in having much less black on the posterior part of the body. The yellow-brown spots continue to near the tip of the tail. The young Polillo specimen is gray, reticulated with black. On the anterior part of the body there are some dim white bars. The anterior part of the belly is flesh-colored; the posterior part and underside of tail black.

Holarchus meyerinkii (Steindachner).

Holarchus meyerinkii TAYLOR, Snakes of the Philippine Islands (1922) 139.

I found a single young specimen of this species near Indanan, Jolo. I unearthed it from under débris collected about the base of a large tree. When exposed it crawled very slowly.

Description.—(No. 1710.) The specimen agrees with that figured in my Snakes of the Philippine Islands in the scalation of the head, save that the nasal is entirely divided instead of only partially. The scale counts are: Ventrals, 157; anal, single;

subcaudals, 46. There are eight lower labials on the left side and seven on the right. Four lower labials touch the first pair of chin shields on the right side, and five on the left. Total length, 160 millimeters; tail, 27.

Color in life.—Above striped, dull salmon pink and brown; a pair of broad, dark brown stripes, each covering two whole and two half rows of scales, separated by a salmon pink, straight-edged, median stripe, covering one whole and two half rows of scales; the inner edge of the brown stripes on either side is deep black, and the outer edge with numerous black dots; below the broad stripes laterally is a flesh-colored stripe covering two half scale rows; below this another brown, black-edged stripe, also covering two half rows of scales; below this another dull flesh-colored line covering parts of two scale rows, below which is another line, nearly black, covering parts of two scale rows; another flesh pink line follows, covering part of the outer scale row and the edges of the ventral, the ventrals with elongate spots on each side forming a narrow black line; belly flesh color to coral pink; a curved, rather broad line crossing head involving eyes; the median brown lines meet on the frontal; a line across the angle of mouth; deep black spots on the anterior ventrals.

Remarks.—The specimens whose scale counts are available give the following variation: 156 to 162 for the ventrals, average 158; subcaudals, 43 to 48, average 45. It will be noted that this form differs from *Holarchus octolineatus* (Schneider) not only in the lower ventral count but also in a very much lower subcaudal count.

Psammodynastes pulverulentus (Boie).

Psammophis pulverulenta BOIE, Isis (1827) 547.
Psammodynastes pulverulentus TAYLOR, Snakes of the Philippine Islands (1922) 209.

Fifteen specimens were collected in Zamboanga, Basilan, and Jolo. I failed to find it in the other localities in which I made collections. This widely distributed species varies greatly in color, but in the material examined I cannot separate any varieties. The table shows the average ventral counts for five Basilan specimens as 170; the average for three Jolo specimens as 152; for the seven specimens from Zamboanga, 163. There is less variation in the subcaudal counts. The known range for ventral and subcaudal counts is 151 to 179, and 53 to 69, respectively. Females are darker for the most part than males.

Table of measurements and scale counts of Psammodynastes pulverulentus (Boie).

No.	Locality.	Collector.	Sex or age.	Length.	Tail.	Ventrals.	Subcaudals.	Preoculars.	Postoculars.	Loreals.	Upper labials.	Lower labials.
				mm.	*mm.*							
1018	Zamboanga.	E. H. Taylor.	♂	315	58	163	58	2-3	2	2	8	7
1080	do	do	yg	290	61	160	62	2	2	1	8	7
1102	do	do	♂	354	75	156	65	2	2	2	8	7
1111	do	do	♀	405	73	168	59	2	2	2	8	7
1112	do	do	♂	395	64	161	[a]44	2	2	1	8	7
1113	do	do	♀	493	90	165	59	2	2	2	8	7
1114	do	do	♀	490	89	167	63	2	2	2	8	7
1482	Basilan	do	♀	445	80	170	55	2	3	2	8	7
1556	do	do	yg	184	34	170	61	2	2	2	8	7
1588	do	do	yg	181	31	179	55	3	2	2	8	7
1591	do	do	♂	345	58	174	55	1	2	1	8	7
1591A	do	do	yg	275	55	160	63	1	2	1	8	7
1722	Jolo	do	yg	365	78	146	59	2	2	2	8	7
1723	do	do	♀	376	67	156	57	2	3	2	8	7
1862	do	do	♀	395	78	154	57	2	3	2	8	7

[a] Tip of tail missing.

Boiga dendrophila divergens Taylor.

Boiga dendrophila divergens TAYLOR, Snakes of the Philippine Islands (1922) 201.

Two specimens of this recently described form have been taken; one (No. 301) in Polillo, the other (No. 2006) on Mount Maquiling, near the School of Forestry. The gray color of No. 2006 is strongly pronounced; the black color of the body merely borders the yellow crossbands. No. 301 has the loreal entering the eye; in No. 2006 the loreal is separated from the orbit by the preocular; the second pair of chin shields is smaller.

Scale counts.—No. 301: Ventrals, 221; subcaudals, 94. No. 2006: Ventrals, 227; subcaudals, 95. No. 301 has 74 yellow bars; No. 2006 has 100.

Remarks.—The fact that the specimens of *Boiga dendrophila* from Luzon and Polillo (the Samar record [13] is doubtful) show more resemblance to the Palawan form than to the Mindanao form is rather inexplicable. Using reptiles and amphibians as criteria there is very little evidence to show that Palawan has ever had any land connection with any part of the Philippines east of the Sulu Sea. In consequence, we would expect that

[13] Taylor, loc. cit.

a Luzon form would show more similarity to the well-defined color form of *Boiga dendrophila latifasciata* which occurs in Mindanao. It is, of course, not improbable that both subspecies occur in Mindanao. However, no specimen of *B. d. divergens* has been found there.

Hemibungarus calligaster (Wiegmann).

Elaps calligaster WIEGMANN, Nova Acta Acad. Leop.-Carol. 1 17 (1835) 253, pl. 20, fig. 2.
Hemibungarus calligaster TAYLOR, Snakes of the Philippine Islands (1922) 269.

Three specimens of this species were obtained at Los Baños; one through the courtesy of Prof. Charles Fuller Baker, dean of the College of Agriculture, the other two from Prof. O. W. Pflueger, director of the School of Forestry. No. 40 presents an interesting variation in the relative length and width of the body, as shown by the table. It varies also from the normal in having the first lower labials separated and the mental in contact with the first pair of chin shields. This condition is also present in No. 41. The very low subcaudal count and the high ventral count of No. 40 are also extraordinary. The tail is doubtless abnormal; there is no evidence that the shortening is due to injury.

It is presumed that these specimens were collected low on Mount Maquiling, about the grounds of the College of Agriculture and the School of Forestry.

Measurements and scale counts of Hemibungarus calligaster (Wiegmann).

	No. 40, ♀.	No. 54, ♀.	No. 41, ♂.
Width of body ..... mm..	6	9	9
Width of head ..... mm..	5.5	8.5	7
Length ..... mm..	460	508	455
Tail ..... mm..	18	26	25
Ventrals	256	224	228
Subcaudals	12	20	20
Lower labials	5	7	6
Labials touch chin shields	3	4	3

Hemibungarus mcclungi Taylor.

Hemibungarus mcclungi TAYLOR, Snakes of the Philippine Islands (1922) 272, pl. 33, fig. 3; pl. 34, figs. 3 and 4.

A specimen of this rare snake was taken on the road to Bislian on Polillo. However, it was attacked by ants when killed and certain of the head scales were destroyed. The characteristic shape of the frontal plate is clearly evident. Total length, 310

millimeters; tail, 26. Anal, single; ventrals, 204; subcaudals, 22.

Color in life.—The body is nearly black above with very indistinct dotted bands of cream on neck; belly banded with intense black and coral red, the red lighter on neck. The black bands below, each incorporating an elongate narrow white stripe.

The species is obviously distinct from *Hemibungarus calligaster* and is very probably confined to Polillo or the Polillo group of islands.

Doliophis philippinus (Günther).

Callophis intestinalis var. *philippina* GÜNTHER, Rept. Brit. India (1864) 349.

Adeniophis philippinus MEYER, Sitzb. Ber. Ak. Wiss. Berlin 36 (1886) 614.

Doliophis philippinus TAYLOR, Snakes of the Philippine Islands (1922) 277, pl. 35, figs. 1 and 2.

A single specimen of this rare species was collected in the mountains lying back of the Zamboanga waterworks intake. It was found near the summit, under a decayed log. When disturbed the tip of the tail was turned up to display the bright red spots beneath.

Description of specimen.—(No. 1100, E. H. Taylor collection.) Female. Total length, 390 millimeters; tail, 26; width of head, 4.5; length, 7.5. Ventrals, 260; subcaudals, 21; anal, single.

Color in life.—Above brown with a black median stripe covering three whole and two half rows of scales, inclosing longitudinal brown spots much longer than the interspaces between them; on either side of the black stripe are narrow brown stripes covering parts of two scale rows; below these a narrow black line which merges in the large black blotches on the belly; black blotches separated by pink to flesh white blotches, which reach the third outer scale row on side; spots below tail bright red.

Naja naja philippinensis Taylor.

Naja naja philippinensis TAYLOR, Snakes of the Philippine Islands (1922) 265.

I have obtained two adult specimens of the Philippine brown cobra; one (No. 869) from Los Baños, presented to me by Prof. C. F. Baker, dean of the College of Agriculture, and a second specimen, collected near Antipolo by Mrs. R. M. McCrory. The Los Baños specimen has a very much longer head than the Antipolo specimen. The measurements are 52 and 43 millimeters, respectively.

Measurements and scale counts of Naja naja philippinensis Taylor.

	No. 869, ♂.	No. 000, ♂.
Length ..... mm.	1,423	1,120
Tail ..... mm.	195	140
Ventrals	190	184
Subcaudals	46	40
Upper labials	7	7
Lower labials	8–9	9
Scale rows:		
Neck	25	23
Body	21	21

Naja naja samarensis (Peters).

Naja tripudians var. *samarensis* PETERS, Mon. Berl. Ak. (1861) 690.
Naja naja samarensis TAYLOR, Snakes of the Philippine Islands (1922) 259.

A single specimen of this subspecies was collected near a trail which follows Tumugao River, some 20 kilometers from Zamboanga.

Color in life.—The specimen is uniform black; the skin between scales, bright yellow. None of the scales has yellow spots. Chin yellow. Beginning with the fifth ventral the following twenty scales are deep black, gradually becoming cream. Outer edge of ventrals of most of the scales with dusky spots.

This subspecies is not rare in Zamboanga; several of the snakes have been seen or killed on the golf links.

Measurements and scale counts of Naja naja samarensis (Peters).

Length (mm.)	1,010
Tail (mm.)	165
Ventrals	173
Subcaudals	48
Scale rows on neck	21
Scale rows around body	19
Upper labials	7
Lower labials	8
Labials touching first chin shields	4

Trimeresurus wagleri wagleri (Boie).

Trimeresurus wagleri wagleri TAYLOR, Snakes of the Philippine Islands (1922) 298.

A specimen of this subspecies has been recently obtained from Balabac Island. It is uniformly green above, with two series of very small white dots on the back. The tail is brown on the tip, and has several larger white dots. Ventrals, 142; anal, single; subcaudals, 51. The subocular is separated from the labials.

ILLUSTRATIONS

PLATE 1

FIG. 1. *Rana yakani* sp. nov.; photograph of a cotype specimen from Basilan, about natural size.

2. *Rana suluensis* Taylor; photograph of specimen from Jolo, enlarged.

3. *Micrixalus diminutiva* sp. nov.; photograph of cotype specimen from Zamboanga; actual length, snout to vent, 20 millimeters.

4. *Micrixalus diminutiva* sp. nov.; photograph of cotype specimen from Zamboanga; actual length, snout to vent, 20 millimeters.

PLATE 2

FIG. 1. *Rana yakani* sp. nov.; photograph of No. 1027, male, a cotype specimen from Zamboanga; actual length, snout to vent, 48 millimeters.

2. *Micrixalus diminutiva* sp. nov.; photograph of the type specimen, from Zamboanga; actual length, snout to vent, 21 millimeters.

3. *Micrixalus diminutiva* sp. nov.; photograph of a specimen from Jolo; actual size, snout to vent, 20 millimeters. Note the lesser extent of webbing on hind foot.

PLATE 3

FIG. 1. *Rana igorota* sp. nov.; photograph of a cotype from Kalinga, about natural size.

2. *Polypedates linki* sp. nov.; photograph of the type specimen.

PLATE 4

FIG. 1. *Tropidophorus stejnegeri* sp. nov.; photograph of the type. The characteristic markings on the back fail to appear in the photograph.

2. *Dibamus argenteus* Taylor; anal region, from a Basilan specimen; enlarged.

3. *Cornufer rivularis* sp. nov.; photograph of the type specimen.

4. *Cornufer montanus* sp. nov.; photograph of the type specimen.

PLATE 1.

1

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PLATE 2.

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PLATE 3.

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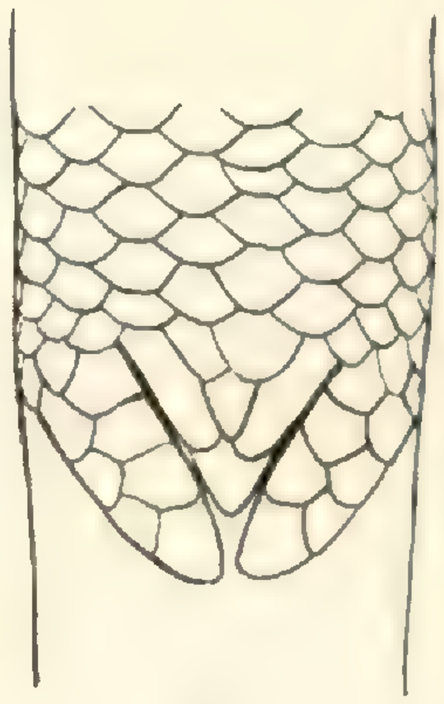

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PLATE 4.

CORRELATION OF DEATH RATES FROM CERTAIN DISEASES WITH CERTAIN ECONOMIC AND HOUSING FACTORS IN THE PHILIPPINE ISLANDS [1]

By RUFINO ABRIOL

ONE TEXT FIGURE

INTRODUCTION

In the work of a health officer there constantly arises a multiplicity of problems which cannot possibly be correctly solved without the application of modern statistical methods. Essential among these methods is correlation. "By the use of this technique, the most complicated problems, which could be attacked in no other way, may be solved."(7) While other statistical methods are being applied to public-health problems with considerable frequency, it can reasonably be said that this is not generally done with the method of correlation. In the solution of biological, anthropological, meteorological, social, and economic problems the theory has found application, but in the domain of vital statistics little use has been made of it.

It is gratifying to realize that in its meager use in vital statistics it has thrown light on numerous fundamental as well as surprising interrelationships between various phenomena; for example, compare Pearl's work on the epidemiology of influenza.(6, 8)

In considering the general health conditions of a community, such as the prevalence of disease, malnutrition, infant mortality, general morbidity, etc., it is generally assumed that there must be a certain relation between these and the housing conditions or economic factors. It is possible that scientific analysis would show that these accepted relations are not so intimate as is generally believed. Also, there is the possibility that the similarity of conditions might not hold universally. As the material herein finds its source in the Philippine Islands, it should be

[1] Papers from the department of biometry and vital statistics, School of Hygiene and Public Health, Johns Hopkins University, No. 49.

borne in mind that variation in conditions doubtless is in some degree responsible for the results here presented.

Concretely, in the Philippine Islands, of necessity, the dwellings are of a construction far different from that found in America or Europe. Whereas in occidental countries warmth, together with protection, must be considered in the construction of homes, in the Philippines, since there exists no need of heating the houses, a loose construction is common that affords perfect ventilation. Thus we find a fundamental difference.

The size of the family per housing unit is generally taken as a criterion of "crowding." In America the evil of this is mostly felt in centers of population, and it is especially among the poorer class and foreign element that this condition flourishes. In the Philippines it must be acknowledged that the same number of people could live under a given roof, the ratio of which would be considered "crowding" in America, and not have the same injurious effect on the health of the Filipinos, due to the difference in climate, ventilation, etc. In fact, with the poorer class, which constitutes the bulk of the population, it is a common occurrence to find several families not only under the same roof but also living in the same room. Consequently, it would appear that, with such close relationships, the possibility of interdetrimentalness would be greater than in the United States; but the neutralizing effect of the facts that dwellings cannot be closed and that they have at all times perfect ventilation must be considered. Therefore, though the figures may show the index of "crowding" in the United States to check numerically that of the Philippines, yet upon application of the correlation method to death rates the resulting effects may be found different, due to other factors. Such was actually found to be the case.

FACTORS CORRELATED

In the development of this idea, by the method of correlation, certain Philippine data were analyzed. For simplicity and with a view to further work along this line, the diseases selected as best suited for this problem are malaria, smallpox, Asiatic cholera, dysentery, leprosy, beriberi, and pulmonary tuberculosis; and, lastly, all causes of death combined were considered. The diseases named are those adopted in the standard classification of the International Nomenclature of Causes of Death. Also, this classification is strictly adhered to in the annual reports of the Philippine Health Service, and was furthermore adopted in the Philippine Census of 1918. The death rates from these dis-

eases per 1,000 population in the various provinces have been correlated with certain economic and housing factors. Thus, should the results warrant following up this problem, there would be a satisfactory basis for comparative work.

SOURCE AND NATURE OF DATA

The data in this work are drawn from the Philippine Census of 1903, taken in March of that year. Therefore, the figures on economic factors, dwellings, and families represent those existing during the early part of 1903. For that year only partial and rather incomplete data on vital statistics are included, while for 1902 comprehensive figures are available. As the census gives figures on the economic, dwelling, and family factors for the early part of 1903, it is considered that the statistics on mortality for 1902 are sufficiently closely related in point of time. Therefore, the data of vital statistics for 1902 and the figures for the economic, dwelling, and family factors for 1903 are herein analyzed.

In considering the provinces with reference to their population and relative wealth, a difficulty presents itself. The objective is the finding of the ratio between the wealth of the provinces and their respective population that will give a concrete measure for statistical use. As the determination of the income of the people is not feasible, the valuation of taxes and personal property and real estate are primarily considered. It seems fairly reasonable to assume that the taxes paid by a community furnish a measure of its wealth. Likewise, the valuation of the personal property and real estate must serve a similar purpose. However, the question that arises is: To what degree can these elements be properly regarded as the measure of the economic status of the province and its people? Total taxes paid or the total value of personal property and real estate does not seem to furnish as true an index of the wealth of the community as when these values are considered with respect to the individuals inhabiting the province. Consequently, the figures have been taken on a per capita basis, and both taxes and property valuations have been used for the correlations.

The property values include personal and real property as given in the census. The taxes do not include customs collections; they do, however, cover the amount of taxes paid for insular, provincial, municipal (town or city), and road purposes. Both the property and the tax values were estimated in the various parts of the Islands by tax assessors, appraisers, the

presidentes,[2] or by the owners of the property. Therefore, although the figures do not represent actual valuations, they can reasonably be accepted as good approximations, accurately comparable among themselves.

The word "family" is herein used in the sense in which it is employed in the United States Census; that is, "a group of persons living under one roof, or in one suite or apartment."(2) No distinction is made, however, between public and private families. A dwelling is considered as one roof, sheltering one or more families.

Certain provinces have been omitted, because of incomplete and unreliable records. Manila, being a city, is also omitted for the simple reason that conditions obtaining there are not comparable with those of the provinces. This is particularly true in respect to the family factor, in which are included a large number of institutions such as prisons, colleges, hospitals, etc. Thirty-nine provinces are included in this work, namely:

Abra.
Albay.
Ambos Camarines.
Antique.
Bataan.
Batangas.
Bohol.
Bulacan.
Cagayan.
Capiz.
Cavite.
Cebu.
Ilocos Norte.
Ilocos Sur.
Iloilo.
Isabela.
Laguna.
La Union.
Leyte.
Marinduque.
Masbate.
Mindoro.
Misamis.
Nueva Ecija.
Nueva Vizcaya.
Occidental Negros.
Oriental Negros.
Palawan.
Pampanga.
Pangasinan.
Rizal.
Romblon.
Samar.
Sorsogon.
Surigao.
Tarlac.
Tayabas.
Zambales.
Zamboanga.

THE CORRELATION METHOD

A brief explanation of the correlation method may be of advantage to those not familiar with it. This method was first introduced on a sound basis by Galton,(4) and later elaborated by Edgeworth,(3) Pearson,(9) Yule,(11) and others. "Two characteristics are said to be correlated when there is a tendency for the changes in the value of one to depend on the

[2] The presidente is an official corresponding to the mayor in an American township or city.

changes in the value of the others."(5) For instance, were death rates and taxes correlated in the various provinces, it would be found that the high death rates occur in the provinces where the taxes are high. This is positive correlation. If, on the other hand, the high death rates were found in provinces where taxes are low, there would also be correlation, but in this case a negative correlation.

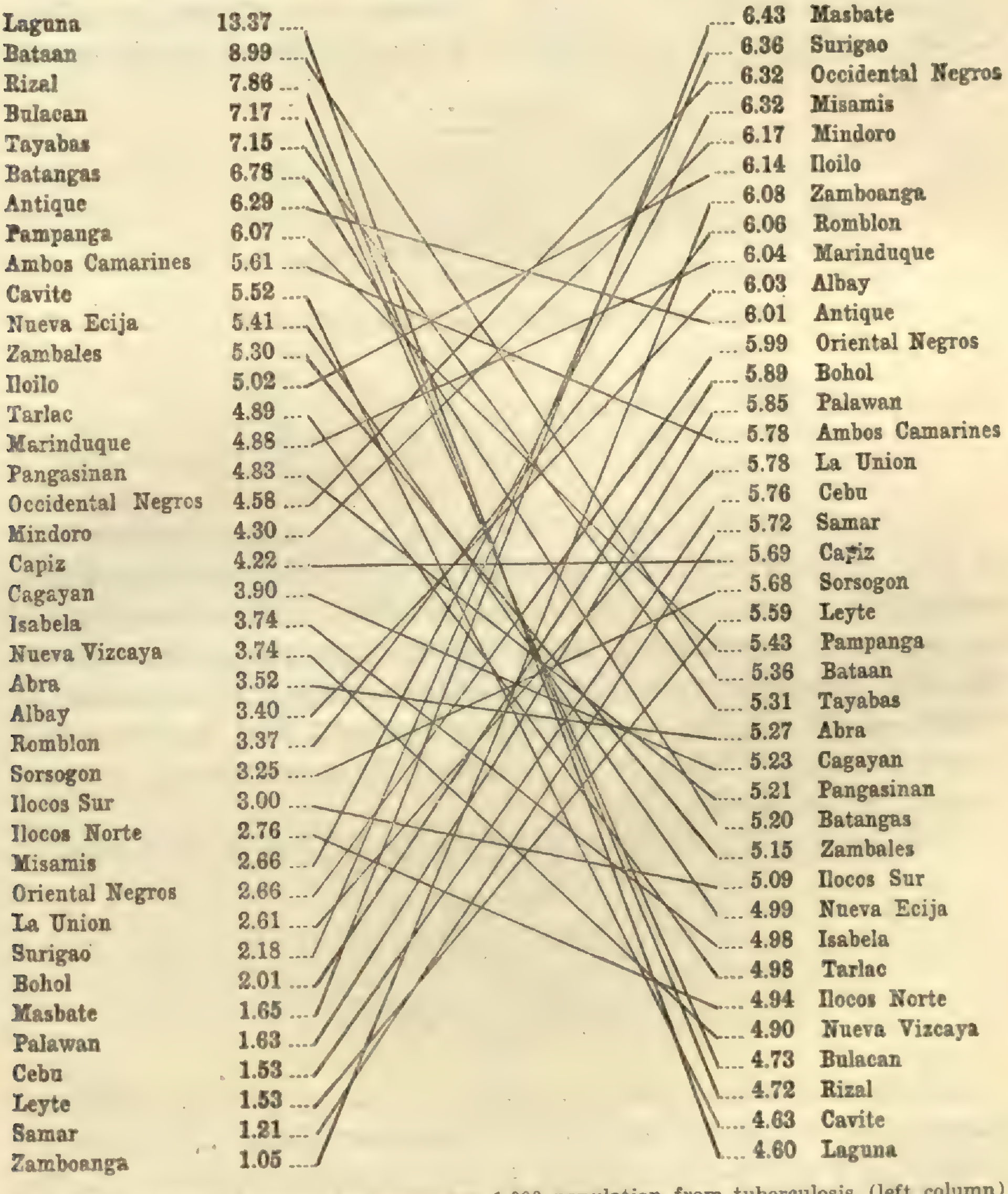

FIG. 1. Correlation between death rate per 1,000 population from tuberculosis (left column) and average number of persons to a dwelling (right column) in certain provinces of the Philippine Islands.

The application of the theory of correlation involves numerous mathematical computations. The simplest method enables one to determine roughly the degree of correlation between two

variables by a simple diagram, such as is shown in fig. 1, without entailing mathematical calculations. Such a method, however, does not enable one to measure the degree of association or correlation. From mere inspection of fig. 1, one may deduce that the higher rates correspond to, or, to use the statistical term, are "correlated" with, the lower figures in the dwellings.

The underlying principle of the method of correlation is the measurement of the association between two values in terms of the coefficient of correlation. This coefficient is expressed as follows:

$$r_{12} = \frac{\Sigma\ (x_1 \cdot x_2)}{N\ \sigma_1\ \sigma_2}$$

where

r_{12} = the correlation coefficient
X_1 and X_2 = the variables correlated
x_1 and x_2 = the deviations from the means of X_1 and X_2, respectively
Σ = summation
σ_1 and σ_2 = the standard deviations of X_1 and X_2
N = number of observations (variates).

The coefficient may vary from 0 to 1, in either the positive or the negative direction, depending upon the nature of the correlation. The numerical value of this coefficient expresses the degree of association, approaching complete correlation as the value approaches unity. In other words, if the value is either -1 or $+1$, the correlation is perfect; that is, for every change in one variable, there is a definite and constant proportional change in the other.

σ_1 and σ_2 are derived according to the following formula:

$$\sigma = \frac{\Sigma\ (x^2)}{N}$$

N = number of pairs
Σ = summation of x^2.

Before conclusions can be drawn from the coefficient of correlation it is necessary to know something about the probable error. The probable error is a conventional measure of the reliability of results.

It is a constant so chosen that when its value is added to and subtracted from the result obtained or the numerical conclusion reached, it is exactly an even chance that the true result or conclusion lies either inside or outside the limits set by the probable error in the plus and minus direction.

For example, if it is stated that the mean age of death of persons dying in Baltimore is 39.83 ± 2.60 years, it means that the mathematical probability that the true average age falls between 37.23 years (39.83 − 2.60) and 42.43 years (39.83 + 2.60) is exactly equal to the mathematical probability that the true age falls outside those limits.(7)

The significance of our results, therefore, can be judged only after considering their relation to their probable errors. Bowly and Hooker(6) consider that when the correlation coefficient is six or more times the probable error it is practically certain that the two factors in question are associated; that is, the coefficient is significant. Raymond Pearl(7) considers a coefficient not significantly different from 0 when it is not more than four times its probable error. This basis of interpreting the probable error and coefficient will be considered as the criterion of significant results in this paper.

ANALYSIS OF RESULTS

The death rates from the diseases under consideration in the thirty-nine provinces are each correlated with the values of the personal property and real estate per capita, with taxes per capita, and with the average number of persons to a dwelling. Table 1 shows the means and the standard deviations of the factors entering into the correlation. Table 2 shows the correlation coefficients. Casual examination of this table reveals a most interesting and rather surprising result, in as much as the coefficients are for the most part contrary to what was expected. For a closer scrutiny and analysis, each of the diseases is considered separately.

TABLE 1.—*Means and standard deviations of death rates from certain diseases and certain economic and housing factors.*

Variable.	Mean.	Standard deviation.
Death rate from all causes	61.57 ±2.63	24.38 ±1.86
Malaria	17.19 ±1.07	9.87 ±0.75
Smallpox	1.99 ±0.35	3.23 ±0.25
Asiatic cholera	18.80 ±1.45	13.40 ±1.02
Dysentery	2.55 ±0.21	1.98 ±0.15
Leprosy	0.017±0.002	0.017±0.001
Beriberi	0.67 ±0.06	0.55 ±0.04
Pulmonary tuberculosis	4.35 ±0.26	2.42 ±0.19
Real estate	78.24 ±6.19	57.32 ±4.38
Taxes	0.96 ±0.07	0 68 ±0.05
Family	4.70 ±0.06	0.52 ±0.04
Dwelling	5.55 ±0.06	0.53 ±0.04

TABLE 2.—*Coefficients of correlation between death rates from certain diseases and certain economic and housing factors.*

Death rate from—	Correlated with—			
	Personal property and real estate.	Taxes.	Persons in family.	Persons in dwelling.
All causes	+0.18±0.10	+0.36±0.09	−0.52±0.08	−0.32±0.10
Malaria	+0.12±0.11	+0.26±0.10	−0.22±0.10	−0.05±0.11
Smallpox	−0.08±0.11	−0.10±0.11	+0.17±0.10	−0.09±0.11
Asiatic cholera	+0.01±0.11	+0.42±0.09	−0.49±0.08	−0.10±0.11
Dysentery	+0.11±0.11	−0.12±0.11	−0.39±0.09	−0.31±0.10
Leprosy	−0.19±0.10	−0.04±0.11	−0.09±0.11	−0.23±0.10
Beriberi	+0.13±0.11	−0.11±0.11	+0.06±0.11	+0.03±0.11
Pulmonary tuberculosis	+0.37±0.09	+0.06±0.11	−0.42±0.09	−0.53±0.08

All causes.—The coefficient with personal property and real estate is +0.18, which, considered with its probable error, ± 0.10, is not significantly different from 0. The coefficient with taxes is just four times its probable error and, therefore, probably though not surely significant. The coefficient with the average number of persons to the family is high, revealing a negative association of the rates with the number of persons in the family; in other words, high death rates occur in provinces where families are small.

Asiatic cholera.—The coefficients with taxes and with number of persons to the family are both significant. It is judged from this that the death rates from cholera are higher among the people in provinces where higher taxes per capita are paid. It furthermore means that the rates are inversely proportional to the number of persons in the family. There is, however, an apparent anomaly in the death rates having a negative correlation with the number of persons in the family and no correlation with the number of persons in the dwelling, considering the fact, alluded to above, that families and dwellings are factors of practically the same nature.

Dysentery.—Economic factors show no association with death rates from dysentery. Number of persons in the family, however, appears to be slightly negatively associated with the rates.

Pulmonary tuberculosis.—In this disease, as in all causes, Asiatic cholera, and dysentery, the association with the number of persons in the family is apparent. Unlike any of the others, however, the correlation with the number of persons in the dwelling is high and negative; in fact, the coefficient for this is the highest obtained in the whole series. This suggests that,

owing to the general social condition obtaining in the Philippine population, the usual relations respecting familial infection are somewhat upset. Taxes, as a factor, show no association. The correlation coefficient with personal property and real estate is shown in Table 2 as being slightly more than four times the probable error. The actual figures, carried to four decimal places, however, are $+0.3708$ with a probable error of ± 0.0932, the former being slightly less than four times the latter. The coefficient, therefore, does not certainly indicate any association of death rates with real estate.

Malaria, smallpox, leprosy, and beriberi.—None of the coefficients for these diseases has any significance.

DISCUSSION

The results presented must be regarded as entirely preliminary to more-detailed statistical analysis. There is involved an element of spurious arithmetical correlation due to the fact that the data correlated are rates having the same denominator for both deaths and economic and social variables. However, it is believed that the preliminary gross results here presented have considerable suggestive value. Yule(12) has argued that in such death-rate correlations the gross coefficients (which include the so-called spurious element) have real significance because they represent what is really the actuality. Greenwood's(1) study of death-rate correlations of cancer and diabetes appears to bear out this contention. Pending further analysis by the methods of partial correlation, to eliminate wholly the spurious element, the present conclusions should be accepted with caution and reservation.

In the consideration of the various correlations it is deemed necessary to note just what may be the effects of civilization upon a people like the Filipinos, presenting as they do a population of heterogeneous character. Down through history, the acquisition of civilization by the so-called primitive peoples has been followed by a general weakening of their natural powers. Attention is drawn to its effects upon the American Indians, for instance. Since they, as nations, possessed no acquired specific immunity against the diseases that follow closely in the path of civilization, they easily succumbed to them. Another effect, closely allied, is the influence upon the size of the families. It is not the general trend of sociological development that the less-enlightened peoples have larger families than those endowed with the benefits of culture and civilization?

Furthermore, it is generally conceded that the people of the better and wealthy class, who naturally represent the portion of the population possessing higher culture and civilization, appear to have lower resistance to disease than the lower and poorer class, who are hardy and live close to nature. The families of the latter class are large; many families live under the same roof; however, due to the climate, they do not cling to the dwelling as do the better and wealthier class. Thus, a large number of persons in the family or dwelling among these people is only an apparent crowding and not a real one.

None of the diseases except Asiatic cholera exhibits association with either real estate or taxes per capita. In cholera there seems to be a definite correlation with taxes, indicating that in the Philippine Islands the death rates from this disease are found highest in the provinces where the population pays relatively higher taxes. If the amount of taxes per capita in a province can be considered as a fair index of the wealth of the population, the conclusion that can be tentatively drawn from this coefficient is that the wealthier the people the more liable they are to infection from cholera. This seemingly puzzling phenomenon is precisely what would be expected if we were to consider the effects of civilization as referred to above. Examination of the data reveals the fact that where death rates are highest, the provinces concerned possess a population of a higher culture than do those which present lower death rates.

The results with the housing factors are likewise puzzling. If the coefficients are to be taken as a true measure of correlation between the death rates and the housing factors, at least as far as all causes, Asiatic cholera, dysentery, and pulmonary tuberculosis are concerned, higher rates are found in provinces where the families are smaller, and in the case of tuberculosis, also, where the average number of persons to a dwelling is lowest. Again, the effects of civilization are offered as a possible explanation of this phenomenon. It has been suggested above that civilization tends to make the families smaller; likewise, it is pointed out that morbidity increases with the advance of civilization. It may be, then, the combined effects of these factors that influence the correlation of death rates with the housing variables. It is to be remembered that the poorer and less-enlightened class is the one that possesses larger families and dwellings with a larger number of occupants. It must be remembered, too, that only numerical crowding exists, and that the dwellings are well ventilated. Then there is the

possibility that the more crowded the dwellings are the greater will be the tendency for the people to live out of doors. They are, consequently, the hardy type, the outdoor-loving people, and therefore the class that possesses higher resistance to disease. This assumption is apparently borne out by the fact that in the provinces in which the death rates are lower and the families larger the population belongs to that class.

TABLE 3.—*Deaths from certain principal causes in certain provinces, Philippine Islands. Data for 1902, Philippine Census, 1903.*

Province.	Cause of death.							
	All causes.	Malaria.	Small-pox.	Asiatic cholera.	Dysentery.	Leprosy.	Beriberi.	Tuberculosis.
Abra	1,296	398	1	464	41	0	6	133
Albay	11,564	3,103	1,239	480	279	2	187	815
Ambos Camarines	10,872	2,634	1,189	1,144	327	1	494	1,309
Antique	7,411	3,181	173	827	372	1	19	826
Bataan	4,479	613	3	2,252	218	0	29	406
Batangas	34,257	13,216	44	10,383	1,784	2	282	1,747
Bohol	10,851	2,748	425	4,883	279	3	30	542
Bulacan	13,015	2,041	248	2,494	413	1	198	1,602
Cagayan	9,783	2,724	2,418	1,375	249	8	57	557
Capiz	15,564	3,254	694	5,903	1,339	4	263	949
Cavite	8,983	2,073	289	1,893	374	2	87	744
Cebu	20,920	7,020	1,269	5,800	216	20	673	1,001
Ilocos Norte	10,657	2,236	238	3,907	1,057	11	28	488
Ilocos Sur	12,694	1,214	4	8,187	293	7	13	521
Iloilo	51,153	16,572	33	21,772	645	5	168	2,028
Isabela	4,584	1,357	569	861	267	1	23	257
Laguna	15,918	4,877	2	4,763	806	3	241	1,987
La Union	8,821	1,008	449	4,647	696	4	30	333
Leyte	17,016	5,011	2,465	3,618	269	8	381	594
Marinduque	3,222	1,466	0	265	156	0	43	252
Masbate	1,881	811	18	664	9	0	7	72
Mindoro	2,466	621	113	854	226	0	66	139
Misamis	9,038	4,961	0	2,386	155	3	190	361
Nueva Ecija	8,487	2,553	121	1,642	332	5	75	720
Nueva Vizcaya	1,228	511	1	433	14	0	1	60
Occidental Negros	24,461	3,220	17	12,710	837	2	72	1,390
Oriental Negros	5,972	2,135	77	1,875	110	8	92	492
Palawan	664	160	0	185	26	0	19	47
Pampanga	14,383	3,247	127	2,672	502	1	60	1,352
Pangasinan	24,701	6,531	104	9,536	1,028	22	86	1,905
Rizal	11,883	1,648	148	3,370	453	3	187	1,167
Romblon	1,422	531	0	164	30	2	33	178
Samar	13,614	3,913	1,789	4,226	253	9	235	320
Sorsogon	4,380	998	82	310	157	1	92	391
Surigao	3,304	1,200	35	1,142	25	1	62	216
Tarlac	7,088	2,453	55	1,464	143	1	34	653
Tayabas	9,418	3,501	1	1,569	680	1	254	1,075
Zambales	6,772	1,398	396	2,180	584	2	16	537
Zamboanga	1,559	366	0	752	64	0	1	41
All provinces	425,781	117,504	14,831	134,052	15,708	144	4,834	28,207

SUMMARY

The coefficients obtained indicate that the death rate from Asiatic cholera are positively correlated with the taxes paid per capita in the provinces. In the provinces where higher taxes are paid, the death rates from this disease are higher.

TABLE 4.—*Death rate per 1,000 population from certain principal causes in certain provinces of the Philippine Islands. Computed from Tables 3 and 5.*

Province.	Cause of death.							
	All causes.	Malaria.	Smallpox.	Asiatic cholera.	Dysentery.	Leprosy.	Beriberi.	Tuberculosis.
Abra	34.26	10.52	0.03	12.27	1.08	0.000	0.16	3.52
Albay	48.30	12.96	5.17	2.00	1.17	0.008	0.78	3.40
Ambos Camarines	46.57	11.28	5.09	4.90	1.40	0.004	2.12	5.61
Antique	56.47	24.24	1.32	6.30	2.83	0.008	0.14	6.29
Bataan	99.17	13.57	0.07	49.86	4.83	0.000	0.64	8.99
Batangas	132.93	51.28	0.17	40.29	6.92	0.008	1.09	6.78
Bohol	40.30	10.21	1.58	18.14	1.04	0.011	0.11	2.01
Bulacan	58.28	9.14	1.11	11.17	1.85	0.004	0.89	7.17
Cagayan	68.50	19.07	16.98	9.63	1.74	0.056	0.40	3.90
Capiz	69.14	14.46	3.08	26.22	5.95	0.018	1.17	4.22
Cavite	66.65	15.38	2.14	14.05	2.77	0.015	0.65	5.52
Cebu	32.00	10.74	1.94	8.87	0.33	0.031	1.03	1.53
Ilocos Norte	60.28	12.65	1.32	22.10	5.98	0.062	0.16	2.76
Ilocos Sur	73.04	6.98	0.02	47.11	1.69	0.040	0.07	3.00
Iloilo	126.64	41.03	0.08	53.90	1.60	0.012	0.42	5.02
Isabela	66.63	19.73	8.27	12.52	3.88	0.015	0.33	3.74
Laguna	107.12	32.82	0.01	32.05	5.42	0.020	1.62	13.37
La Union	69.03	7.89	3.51	36.36	5.45	0.031	0.23	2.61
Leyte	43.75	12.88	6.34	9.30	0.69	0.021	0.98	1.53
Marinduque	62.35	28.37	0.00	5.13	3.02	0.000	0.83	4.88
Masbate	43.07	18.57	0.41	15.20	0.21	0.000	0.16	1.65
Mindoro	76.30	19.22	3.50	26.42	6.99	0.000	2.04	4.30
Misamis	66.71	36.62	0.00	17.61	1.14	0.022	1.40	2.66
Nueva Ecija	63.81	19.20	0.91	12.35	2.50	0.038	0.56	5.41
Nueva Vizcaya	76.63	31.89	0.06	27.02	0.87	0.000	0.06	3.74
Occidental Negros	80.55	10.60	0.06	41.86	2.76	0.007	0.24	4.58
Oriental Negros	32.30	11.55	0.42	10.14	0.59	0.043	0.50	2.66
Palawan	23.01	5.55	0.00	6.41	0.90	0.000	0.66	1.63
Pampanga	64.60	14.58	0.57	12.00	2.25	0.004	0.27	6.07
Pangasinan	62.61	16.55	0.26	24.17	2.61	0.056	0.22	4.83
Rizal	80.02	11.10	1.00	22.69	3.05	0.020	1.26	7.86
Romblon	26.91	10.05	0.00	3.10	0.57	0.038	0.62	3.37
Samar	51.27	14.74	6.74	15.91	0.95	0.034	0.88	1.21
Sorsogon	36.36	8.29	0.68	2.57	1.30	0.008	0.76	3.25
Surigao	33.27	12.08	0.35	11.50	0.25	0.010	0.62	2.18
Tarlac	53.09	18.37	0.41	10.97	1.07	0.007	0.25	4.89
Tayabas	62.68	23.30	0.01	10.44	4.53	0.007	1.69	7.15
Zambales	66.80	13.79	3.91	21.50	5.76	0.020	0.16	5.30
Zamboanga	39.79	9.34	0.00	19.19	1.63	0.000	0.03	1.05
All provinces	63.19	17.44	2.20	19.89	2.33	0.021	0.72	4.19

In the case of all causes, Asiatic cholera, dysentery, and pulmonary tuberculosis, the higher death rates are found in the provinces where the average number of persons in the family is lower. In pulmonary tuberculosis alone there is a significant

TABLE 5.—*Civilized population, total dwellings and families, and average number of persons to a dwelling and a family in certain provinces of the Philippine Islands. Data for year 1903, Philippine Census, 1903.*

Province.	Population.	Dwelling.	Families.	Average persons per—	
				Dwelling.	Family.
Abra	37,823	7,177	9,072	5.27	4.17
Albay	239,434	39,720	50,563	6.03	4.74
Ambos Camarines	283,472	40,410	48,826	5.78	4.78
Antique	131,245	21,842	24,701	6.01	5.31
Bataan	45,166	8,432	9,928	5.36	4.55
Batangas	257,715	49,538	63,831	5.20	4.04
Bohol	269,223	45,687	46,901	5.89	5.74
Bulacan	223,327	47,212	49,266	4.73	4.53
Cagayan	142,825	27,297	28,328	5.23	5.04
Capiz	225,092	39,544	48,769	5.69	4.62
Cavite	134,779	29,124	33,853	4.63	3.98
Cebu	653,727	113,481	116,069	5.76	5.63
Ilocos Norte	176,785	35,811	43,773	4.94	4.04
Ilocos Sur	173,800	34,124	44,180	5.09	3.93
Iloilo	403,932	65,795	94,454	6.14	4.28
Isabela	68,793	13,814	14,627	4.98	4.70
Laguna	148,606	32,308	37,217	4.60	3.99
La Union	127,789	22,117	28,030	5.78	4.56
Leyte	388,922	69,526	71,659	5.59	5.43
Marinduque	51,674	8,550	9,445	6.04	5.47
Masbate	43,675	6,790	8,493	6.43	5.14
Mindoro	32,318	5,236	7,232	6.17	4.47
Misamis	135,473	21,443	25,611	6.32	5.29
Nueva Ecija	132,999	26,630	30,664	4.99	4.34
Nueva Vizcaya	16,026	3,269	4,470	4.90	3.59
Occidental Negros	303,660	48,030	68,027	6.32	4.44
Oriental Negros	184,889	30,889	36,970	5.99	5.00
Palawan	28,852	4,928	6,420	5.85	4.49
Pampanga	222,656	40,994	47,257	5.43	4.71
Pangasinan	394,516	75,652	92,080	5.21	4.28
Rizal	148,502	31,466	31,957	4.72	4.65
Romblon	52,848	8,726	11,046	6.06	4.78
Samar	265,549	46,428	56,121	5.72	4.73
Sorsogon	120,454	21,205	23,582	5.68	5.11
Surigao	99,298	15,620	17,265	6.36	5.75
Tarlac	133,513	26,820	31,029	4.98	4.30
Tayabas	150,262	28,302	32,231	5.31	4.66
Zambales	101,381	19,675	21,810	5.15	4.65
Zamboanga	39,177	6,445	7,408	6.08	5.29
All provinces	6,740,177	1,220,057	1,433,465	5.52	4.70

correlation with the number of persons to the dwelling. The coefficient being negative, the conclusion suggested is that pulmonary tuberculosis brings about a higher death rate in less-

TABLE 6.—*Taxes, personal property and real estate in certain provinces in the Philippine Islands. Data for year 1903, Philippine Census, 1903.*

[One peso Philippine currency is equivalent to 50 cents United States currency.]

Province.	Population.	Personal property and real estate.	Total taxes.	Per capita—	
				Personal property and real estate.	Taxes.
		Pesos.	*Pesos.*	*Pesos.*	*Pesos.*
Abra	37,823	2,519,141	24,437	66.60	0.65
Albay	239,434	20,093,494	209,519	83.92	0.88
Ambos Camarines	233,472	19,145,796	185,404	82.01	0.79
Antique	131,245	4,729,448	73,203	36.04	0.56
Bataan	45,166	4,192,727	64,882	92.83	1.44
Batangas	257,715	16,746,641	94,016	64.98	0.36
Bohol	269,223	10,339,489	108,313	38.40	0.40
Bulacan	223,327	23,092,072	133,512	103.40	0.60
Cagayan	142,825	8,463,750	137,155	59.26	0.96
Capiz	225,092	14,749,631	116,962	65.53	0.52
Cavite	134,779	9,516,387	109,927	70.61	0.82
Cebu	653,727	28,006,833	1,062,346	42.84	1.63
Ilocos Norte	176,785	9,838,973	127,156	55.66	0.72
Ilocos Sur	173,800	9,673,426	243,799	55.66	1.40
Iloilo	403,932	36,165,306	1,889,352	89.53	4.68
Isabela	68,793	3,897,809	95,662	56.66	1.39
Laguna	148,606	21,147,665	162,024	142.31	1.09
La Union	127,789	7,148,716	136,276	55.94	1.07
Leyte	388,922	36,751,003	248,750	94.49	0.64
Marinduque	51,674	5,384,084	37,411	104.19	0.72
Masbate	43,675	1,498,159	63,546	34.30	1.45
Mindoro	32,318	3,874,877	13,914	119.90	0.43
Misamis	135,473	5,392,478	107,261	39.80	0.79
Nueva Ecija	132,999	10,061,985	79,612	75.66	0.60
Nueva Vizcaya	16,026	1,013,865	12,005	63.26	0.75
Occidental Negros	303,660	24,866,738	269,961	81.89	0.89
Oriental Negros	184,889	9,507,844	132,740	51.43	0.72
Palawan	28,852	426,054	18,619	14.77	0.65
Pampanga	222,656	20,684,237	178,213	92.90	0.80
Pangasinan	394,516	28,802,738	300,380	73.01	0.76
Rizal	148,502	14,528,570	143,866	97.83	0.97
Romblon	52,848	1,673,029	52,187	31.66	0.99
Samar	265,549	13,439,701	87,057	50.61	0.33
Sorsogon	120,454	10,735,815	154,075	89.13	1.28
Surigao	99,298	3,499,377	66,263	35.24	0.67
Tarlac	133,513	51,764,605	105,650	387.71	0.79
Tayabas	150,262	18,827,450	203,001	125.30	1.35
Zambales	101,381	7,912,530	79,228	78.05	0.78
Zamboanga	39,177	1,883,335	47,423	48.07	1.21
All provinces	6,740,177	521,995,778	7,375,107	77.46	1.09

crowded dwellings. This, however, probably only means that both variables are correlated with other general social factors. All of the conclusions in this paper are to be regarded merely as suggestive rather than final, until they can be checked by further and more-refined statistical analysis.

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REFERENCES

1. Brown, J. W.; Greenwood, M.; and Wood, F. A study of index correlations. Journ. Roy. Stat. Soc. 77 (1914) 317–346.
2. Census of the Philippine Islands, 1903. U. S. Bureau of Census, Washington, D. C. 2, 3, 4 (1905).
3. Edgeworth, F. Y. On correlated averages. Phil. Mag. London 34 (1892) 194, cited by Yule.
4. Galton, Francis. Family likeness in stature. Proc. Roy. Soc. London 40 (1886) 42, cited by Yule.
5. Hooker, R. H. Correlation of weather and crops. Journ. Roy. Stat. Soc. 70 (1907) 1.
6. Pearl, Raymond. Influenza studies, I. On the general statistical aspects of the 1918 epidemic in American cities. Publ. Health Repts. 34 (1919) 1743–1783.
7. Pearl, R. The significance of biometry and vital statistics to science of medicine. Nelson Loose-Leaf Medicine, New York 2 (1920).
8. Pearl, R. Influenza studies, II. Further data on the correlation of explosiveness of outbreak of the 1918 epidemic. III. On the correlation of destructiveness of the 1918 epidemic. IV. On the correlation between explosiveness and total destructiveness of the epidemic mortality. Publ. Health Repts. 36 (1921) 273–298.
9. Pearson, K. Regression, heredity, and panmixia. Phil. Trans. Roy. Soc., London Ser. A, 187 (1896) 253, cited by Yule.
10. West, C. J. Introduction to Mathematical Statistics. Columbus, R. G. Adams and Company (1918).
11. Yule, G. U. On the theory of correlation. Journ. Roy. Stat. Soc. 60 (1897) 812.
12. Yule, G. U. On the interpretation of correlations between indices or ratios. Journ. Roy. Stat. Soc. 73 (1910) 644.

ILLUSTRATION

TEXT FIGURE

FIG. 1. Chart, showing correlation between death rate per 1,000 population from tuberculosis (left column) and average number of persons to a dwelling (right column) in certain provinces of the Philippine Islands.

NOTES ON THE LIOPTERINÆ WITH DESCRIPTIONS OF NEW SPECIES FROM THE ORIENTAL REGION (HYMENOPTERA, CYNIPIDÆ)

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ONE PLATE

In a recent sending by Prof. Charles F. Baker of parasitic Cynipidæ from the Oriental Region several new species were recognized as belonging to the Liopterinæ and are here described. The first and third specimens of each sex have been retained for the United States National Museum collection and the second and fourth paratypes returned to Professor Baker.

The subfamily Liopterinæ as here treated includes both *Dalla-torrella* Kieffer, a genus which has been proposed [1] and made a separate subfamily since the publication of the last monograph on the Cynipidæ,[2] and the closely related genus *Mesocynips* Cameron, which the Tierreich placed provisionally in the Cynipinæ. It is distinguished from the Oberthürellinæ, known only from Africa, by the lack of a tooth on the hind femur and the absence of a spine on scutellum; but, like that subfamily, the Liopterinæ has the abdomen attached high on the propodeum instead of between the hind coxæ; has the first abdominal segment (petiole) plainly visible and longitudinally ridged; and has the fourth or fifth tergite (the third only in *Xenocynips*) largest when seen in side view with usually two, and often three, short tergites behind the petiole preceding this big segment, and these may or may not be tongue-shaped. Both subfamilies have a somewhat similar habitus, being relatively large, stout species with the mesoscutum coarsely and usually transversely sculptured. Two new genera have been added to the Oberthürellinæ since the Tierreich monograph, and a key to the genera compiled from the literature is here included for that subfamily also.

[1] Bull. Soc. ent. Ital. 41 (1911) 244–246.

[2] Dalla Torre and Kieffer, Das Tierreich, Lief. 24 (1910) 1–17.

Key to the subfamilies.

Hind femur with a conspicuous tooth or spine on underside between middle and apex. Scutellum prolonged behind into a long spine with a short tooth on each side at base (Plate 1, fig. 1). Africa.
Oberthürellinæ.

Hind femur unarmed. Scutellum not ending in a spine. Petiole longitudinally ridged and arising at or above middle of propodeum. Scutellum never with cup. Fourth or fifth tergite of abdomen largest when seen fom side, and abdomen never knifelike as in *Ibalia*.
Liopterinæ.

Key to the genera of the Oberthürellinæ.

1. Metatarsus of hind leg as long as 2–5. The sharp rim of hind margin of the pronotum raised into a distinct vertical median tooth at anterior end of mesoscutum. Tooth on femur oblique with a conspicuous lobe between it and distal end. Petiole with two longitudinal ridges above converging anteriorly. Scutellum with three pits.
Tessmannella Hedicke.

Metatarsus of hind leg not as long as 2–5. Pronotum without distinct median tooth behind. Tooth on femur perpendicular without lobe between it and apex. Petiole with about eight parallel ridges..... 2.

2. Tergites 2 to 4 liguliform, fifth about equal to 2 to 4 united. Scutellum with three pits at base (Plate 1, fig. 1)..... **Oberthürella Kieffer.**

Tergites 2 to 4 not liguliform, third tergite longest. Scutellum with two pits at base..... **Xenocynips Kieffer.**

Key to the genera of the Liopterinæ.

1. Metatarsus or second segment of posterior tarsus of female with a prolongation on one side as in *Ibalia* (Plate 1, fig. 2, *c*)..... 2.

Metatarsus and second segment of posterior tarsus of male and female without such prolongation..... 4.

2. Prolongation is on metatarsus. Prothorax truncate. Petiole not over one-fourth length of abdomen. Scutellum rounded behind. Forewing margin ciliate ..... 3.

Prolongation is on second tarsal segment. Prothorax not truncate. Petiole six to seven times as long as broad and almost equal to abdomen. Scutellum bidentate behind. Forewing margin not ciliate. Africa..... **Plastibalia Kieffer.**

3. Prolongation on inner side of metatarsus. Petiole three to four times as long as broad..... **Pseudibalia Kieffer.**

Prolongation on outer side of metatarsus as in *Ibalia*. Petiole not longer than broad..... **Paribalia gen. nov.**

4. Petiole at least twice and usually three to four times as long as wide, as long as or longer than hind coxa, and one-third length of abdomen and attached tangent to its dorsal curvature. In side view tergite 4 largest in female..... 7.

Petiole not longer than broad, shorter than hind coxa, attached to very front end of the abdomen in the usual position..... 5.

5. Antenna of male 14-segmented. Cubitus arising at or near middle of basal. In side view tergite 5 largest in female (Plate 1, figs. 5 and 6)..... **Allocynips Kieffer.**

Antenna of male 15-segmented. Cubitus arising on upper quarter of basal ..... 6.

6. Malar space one-third eye. Front metatarsus equal to 2–5 united (Plate 1, fig. 3). Hind tibia smooth with two equal spines and one shorter opposite..... **Mesocynips Cameron.**
Malar space as long as eye. Front metatarsus equal to 2–4 united. Hind tibia with longitudinal ridges and two equal spines at apex. **Dallatorrella Kieffer.**
7. Scutellum rounded behind. Antennæ laterally compressed. South America..... **Peras Westwood.**
Scutellum with two teeth behind. Antennæ filiform. South America. 8.
8. Propodeum conical with abdomen attached at apex; that is, the dorsal and ventral lengths equal. Africa..... **Heterocynips Kieffer.**
Propodeum with dorsal distance to petiole horizontal, straight, and much shorter than the ventral, which is much longer and very convex (Plate 1, fig. 4)..... **Liopteron Perty.**

Genus **PARIBALIA** novum

This new genus in Liopterinæ differs from *Pseudibalia* Kieffer, founded on a species from Mexico, by having the tarsal spur not on the inner but on the outer side of the metatarsus, and in having the petiole transverse instead of three or four times as long as broad (Plate 1, fig. 2). In habitus it resembles *Allocynips* Kieffer which has no prolongation on any tarsal segment, but both have the aspect of an *Ibalia* except that the abdomen is shorter and not so strongly compressed.

Head broader than thorax, not broadened behind eyes, malar space without groove, cheeks margined. Antennæ arising above level of middle of eyes, 13-segmented in female, 14-segmented in male, all flagellar segments cylindrical and closely joined in both sexes, segment 3 always shorter than 4. Pronotum broadly truncate, with median tooth on hind margin. Mesoscutum coarsely and transversely sculptured, scarcely arched. Parapsidal grooves complete. Scutellum rounded behind with two pits at base. Propodeum with its distinct neck for the attachment of abdomen as far from the hind coxæ as from metanotum, the usual carinæ stout, curved outwardly, inclosing an area crossed above middle by a transverse ridge above which is a single median, and below two parallel longitudinal ridges as in *Allocynips*. Wing pubescent and ciliate, without areolet, radial cell closed. Spur at apex of hind metatarsus on outer side and not reaching end of second segment, its end truncate. All claws simple. Petiole not longer than broad, longitudinally ridged. Abdomen twice as long as high, somewhat more compressed in the female than in the male but not knifelike as in *Ibalia*. In side view tergite 4 is largest in male and 5 in female, 2 and 3 and 2 to 4 not liguliform, dorsal edge back of tergite 2 sharp in female, not in male.

The genus is founded on a single species, *Paribalia borneana* sp. nov. from Borneo, which is here described.

Paribalia borneana sp. nov. Plate 1, fig. 2.

Female.—Black with abdomen, first and second legs, and tibia and tarsus of third red, rest of hind leg infuscated. Head from above transverse, broader than thorax, occiput concave, from in front widest at level of antennæ, finely punctate, covered with appressed white pubescence. Interocular space 0.56 eye. Eyes bare, oval, width 0.86 length. From each antenna a smooth shallow groove leads back on frons between lateral ocellus and eye, bounding a raised triangular area which bears the ocelli. Antennæ 13-segmented, all cylindrical and closely joined, lengths as 20 (width 8) : 9 : 14 (width 7) : 19 : 17 : 16 : 15 : 14 : 12 : 11 : 11 : 10 : 21 (width 10). Prothorax with setigerous punctures on sides, its truncation as broad as pronotum, more finely punctate and faintly margined on sides; hind margin raised into a broad, blunt, median tooth, which is prominent in profile. Mesoscutum broader than long, triangular in front, coarsely sculptured with about eight or nine sharp, transverse, interrupted ridges giving it the appearance of a wood rasp with a white hair arising behind each tooth. Parapsidal grooves complete, broader behind; median groove narrower and reaching forward halfway. Scutellum rounded behind, with large umbilicate punctures, base with two large, deep, smooth, quadrangular pits separated by a thin carina, sides deeply hollowed out and the impressed areas filled with close white pubescence. Mesopleura with a longitudinal groove in the central bare polished area, above and below which are pubescent areas. Metanotum with two medial pits. Sides of propodeum areolate and pubescent, its neck rugose and arising as far from hind coxæ as from metanotum. Hind legs much the stoutest. Hind tarsus longer than tibia, metatarsus about equal to three following, shorter than fifth (without its claw), its appendage on outer side not quite reaching end of second. Claws simple. Forewing not quite reaching tip of abdomen, distal half slightly smoky, pubescent and ciliate, veins brown, those inclosing radial cell very heavy. First abscissa of radius slightly curved, second straight and forming an angle of 24° with the slightly longer marginal, radial cell 2.9 times as long as broad. Cubitus faint, no costal hinge or areolet. Only subcosta of hind wing visible. Petiole with about twenty ridges. Abdomen longer than head and thorax, twice as long as high, width three-fourths height (Plate 1, fig. 2, *a*). Lengths of tergites measured along dorsal

curvature are as (petiole) 13 (width 26) : 33 : 21 : 27 : 75 : 32. Seventh not visible. Slight pubescent patches in middle of sides of 5 and larger ones on anterior half of 6. Ventral valves protruding horizontally with and slightly farther than the ventral spine. Ovipositor probably very long. Using width of head as a base the length of mesonotum ratio is 1.16; length of antenna, 2.1; wing, 2.7. Length, 4.5 millimeters.

Male.—Differs from female in abdomen being shorter than head and thorax, and in having a larger petiole. Dorsal lengths of tergites are as (petiole) 17 (width 19) : 27 : 20 : 23 : 19 : 16 : 19. Punctured and pubescent area near anterior margin of 5, larger one on 6, and covering 7. In side view the fourth tergite is largest. In ventral view the sternites are visible. Abdomen is twice as long as high, only slightly compressed, width seven-eighths height (Plate 1, fig. 2, *b*). The lengths of segments of antenna are as 16 : 9 : 13 : 19 : 19 : 19 : 18 : 18 17 : 15 : 14, rest broken off, all flagellar segments cylindrical and closely joined as in female. Length, 3.6 millimeters.

Described from 1 male and 1 female, collected at Sandakan, Borneo (*C. F. Baker*).

Type.—Catalogue No. 24375, United States National Museum. Type female and allotype.

Genus **ALLOCYNIPS** Kieffer

In addition to the characters given by Kieffer the following notes apply to all the species seen. Head broader than thorax, not broadened behind eyes. Malar space without groove. Cheeks margined. Antennæ 13-segmented in female, 14-segmented in male, filiform, all flagellar segments cylindrical in both sexes, segment 3 always shorter than 4. Truncation of prothorax nearly as broad as pronotum, margined, hind margin of pronotum forming a sharp rim raised above the level of adjacent mesoscutum and with or without an erect median tooth. Mesoscutum coarsely sculptured, low-arched. Scutellum without spine behind. Propodeum with its distinct neck for attachment of abdomen as far from hind coxæ as from metanotum, the usual carinæ stout, curved outward, inclosing an area crossed above the middle by a horizontal ridge, above which is a single median, and below two fainter longitudinal ridges. Wing margin ciliate, areolet and costal hinge wanting. Petiole longitudinally ridged, as long as broad in only one species (female unknown). Abdomen somewhat compressed in the females. In side view tergite 4 is largest in the males and 5 in the females, 2 and 3 and 2 to 4 not liguliform. In the females all the tergites back of 2 are

angled along median dorsal line so that abdomen is sharp-edged above, not so in males.

Key to species of Allocynips Kieffer.

1. Mesoscutum with sharp transverse ridges, an erect median tooth developed anteriorly on hind margin of pronotum..... 2.
   Mesoscutum coarsely sculptured with deep punctures arranged somewhat in transverse rows, the hind margin of pronotum forming a sharp rim raised above the adjacent mesoscutum but not showing a median erect tooth ..... 3.
2. Mesoscutum without median groove. Radial cell 4.7 times as long as broad.....**A. ruficeps** Kieffer.
   Mesoscutum with median groove posteriorly. Radial cell 2.9 times as long as broad.....**A. dyak sp. nov.**
3. Frons without antennal groove, ocelli not on elevated triangular area. Scutellum with transverse groove at base in which are two or three longitudinal ridges—not two distinct pits ..... **A. malayensis sp. nov.**
   Frons with distinct antennal grooves bounding the sides of a distinctly elevated area bearing the ocelli above. Scutellum with two distinct smooth pits separated by a thin septum.....4.
4. Scutellum disk sharp-edged at side and behind, overhanging metanotum. Radial cell clear, its veins heavy but not clouded.....**A. clara sp. nov.**
   Scutellum not margined, not overhanging metanotum. Radial cell or its veins distinctly clouded..... 5.
5. Forewing clouded along veins of radial cell, the first cubital and apical cells clear. Abdomen not as long as rest of body. Radial cell broadest at base, 2.2 times as long as broad, first abscissa of radius at angle of 90° to second, which is straight and about equal to marginal so that radial cell is almost an isosceles triangle.
   A. isosceles sp. nov.
   Forewing with first cubital, radial, and proximal third of apical cell clouded. Abdomen as long as rest of body.....6.
6. Cheek 0.7 eye. Mesoscutum broader than long, dark red. Seventh tergite not visible. Ventral valve protruding but ventral spine inconspicuous. Radial cell broadest one-fourth way to apex, 3.6 times as long as broad, first abscissa of radius making angle of 130° with second, which is distinctly shorter than marginal.
   A. borneensis sp. nov.
   Cheek half length of eye. Mesoscutum as long as broad, clay yellow. Seventh tergite distinctly visible. Ventral spine two to three times as long as broad.....**A. flaviceps** Kieffer.

Allocynips ruficeps Kieffer.

This species, the genotype, was described [3] in 1914 from a male from Luzon. In this sending were two males, one from Sandakan, Borneo (*Baker*) and one from Singapore (*Baker*) which agree with the description of *A. ruficeps*. When the antennæ are mounted in balsam and measured with a micrometer they are

[3] Philip. Journ. Sci. § D 9 (1914) 186.

found to be slightly longer (1.03 times) than the body. Using the width of the head as a base, the length of mesonotum ratio is 1.2; antenna, 3.7; wing, 3.2. Length, 4.9 and 6.7 millimeters.

Allocynips dyak sp. nov.

Female.—Resembles *Pseudibalia borneana* Weld in color and sculpture but entirely lacking the appendage at apex of the metatarsus. Ocelli on a triangular elevation on frons bounded laterally by the broad smooth antennal grooves. Interocular space 0.55 transfacial and area 1.1 times as broad as high. Malar space 0.58 eye. Facial line 0.8 transfacial. Antennæ arising above level of middle of eyes, 13-segmented, lengths as (scape) 25 (width 9) : 10 : 16 (width 7) : 22 : 19 : 19 : 17 : 16 : 15 : 14 : 13 : 12 : 25 (width 11), all flagellar segments cylindrical, closely joined, gradually stouter toward apex. Radial cell 2.9 times as long as broad, cubitus reaching basal. Hind tibia as long as tarsus. Abdomen with lengths of tergites measured along dorsal curvature as (petiole) 10 (width 24) : 40 : 23 : 27 : 54 : 28, seventh not visible, ventral valves not protruding, tergite 5 microscopically punctate with sparsely pubescent patches on sides and a densely pubescent larger area on 6. Using width of head as a base the length of mesonotum ratio is 1.18; antenna, 2.35; wing, 2.77. Length, 4.2 millimeters; abdomen, 2.1; wing, 3.6; antenna, 3.

Described from 2 females collected at Sandakan, Borneo (*Baker*).

Type.—Catalogue No. 24376, United States National Museum. Type, female.

Allocynips malayensis sp. nov.

Female.—Black, antennæ piceous, legs brown distally. Head transverse, broader than thorax, finely punctate except for a smooth but not grooved area above antennæ, ocelli not on a prominently elevated triangle. Head not broadened behind eyes, cheeks margined. Median ridge from between antennæ to clypeus. Facial line 0.89 transfacial. Interocular space 0.52 transfacial and area 1.1 times as broad as high. Malar space 0.64 eye, without groove. Antennæ arising above middle of eyes, 13-segmented, lengths as (scape) 19 : 6 : 15 (width 6) : 21 : 20 : 19 : 17 : 16 : 14 : 11 : 10 : 9 (width 8) : 19, all flagellar segments cylindrical and closely joined. Pronotum broadly truncate, sides coarsely punctate, hind margin not raised into a median tooth but its sharp rim higher than adjacent mesoscutum, truncation margined on sides. Mesoscutum broader than long,

twice length of pronotum, with rows of umbilicate punctures giving effect of transverse ridges, parapsidal grooves complete. Scutellum rounded behind, not margined, coarsely punctured, base with transverse depression in which are longitudinal ridges, not two distinct pits. Mesopleura with a prominent shallow longitudinal groove below a bare polished area, above which under tegulæ is a large white pubescent depression. Propodeum conical, its neck rugose and shorter than the grooved petiole, sides areolate and pubescent, usual carinæ converging above, inclosed area crossed by a horizontal ridge above which is a single, and below are two fainter longitudinal ridges. Hind leg stoutest, tarsus longer than tibia, metatarsus longer than 2–4 but shorter than 2–5, claws simple. Forewing with the closed radial cell in a large cloud, its veins heavy, cell 3.6 times as broad as long, cubitus reaching basal just above middle, no costal hinge, no areolet, surface pubescent, margin ciliate. Abdomen as long as head and thorax, elliptical in outline from side, twice as long as high, slightly compressed, width 0.6 height, lengths of tergites measured along dorsal curvature as (petiole) 12 (width 25) : 30 : 19 : 19 : 64 : 19 : 18, pubescent area in center of tergite 5, broader one on 6 and on whole of 7. Ventral valves horizontal, prominent. Hypopygium occupying almost whole of ventral surface, ventral spine short. Using width of head as a base the length of mesonotum ratio is 1.1; antenna, 2.4; wing, 3. Length, 4 and 4.3 millimeters.

Male.—Antennæ 14-segmented, lengths (scape) 18 : 8 : 25 : 29 (width 9) : 30 : 30 : 30 : 29 : 28 : 27 : 26 : 26 : 25 : 32 (width 6). Abdomen shorter than head and thorax, lengths as (petiole) 13 (width 15) : 26 : 17 : 18 : 17 : 15 : 15, tergite 4 largest in side view, 5, 6, and 7 microscopically punctate, a few hairs in middle of 5, more in 6, and covering 7. Length, 2.9 and 4 millimeters.

Described from 2 females and 2 males collected at Sandakan, Borneo (*Baker*).

Type.—Catalogue No. 24377, United States National Museum. Type female and allotype.

Allocynips clara sp. nov.

Male.—Black; pronotum, mesoscutum, and base of scutellum red. Head coarsely rugose-punctate, with median ridge on sparsely pubescent face, ocelli on a coarsely sculptured triangular elevation bounded on sides by finely punctured antennal grooves. Interocular space 0.57 transfacial and area 1.1 times as broad as high. Malar space 0.5 eye. Antennæ 14-segmented, filiform, lengths as (scape) 26 (width 11) : 9 : 18 (width 9) : 24 (width

10) : 24 : 24 : 21 : 21 : 20 : 19 : 19 : 19 : 17 : 27 (width 9), all closely joined. Truncation of prothorax broad, smooth, slightly margined, hind margin a sharp raised rim without median tooth. Mesoscutum longer than broad, coarsely sculptured with deep setigerous punctures in transverse rows, complete parapsidal grooves faintly indicated, no median. Scutellum 0.43 mesoscutum; disk black, coarsely and deeply punctured above, margined, with vertical ridges below, overhanging metanotum; pits at base longer than broad, bottom flat, smooth and polished, separated by a septum; impressed areas on sides. Propodeum as in *A. malayensis*. Hind tarsus longer than tibia, metatarsus longer than 2–4, shorter than 2–5, claws simple. Forewing subhyaline, veins yellowish and not clouded. Surface bare back of submarginal as far as basal, rest pubescent, margin ciliate, cubitus reaching basal just above middle, radial cell closed, 3.1 times as long as broad, first abscissa of radius arcuate, 0.4 length of second which is nearly straight. Abdomen longer than thorax, length: width as 42.25, lengths of tergites measured along dorsal curvature as (petiole) 14 (width 27) : 46 : 27 : 27 : 21 : 20 : 30. In side view tergite 4 largest, 5 microscopically punctate with transverse line of pubescence near front margin, on front half of 6, and covering 7. Six sternites visible. Using width of head as a base the length of mesonotum ratio is 1.68; antenna, 2.66; wing, 2.65. Length, 5.1 millimeters; antenna, 4.1; abdomen, 2.1; wing, 4.

Described from 1 male from Dapitan, Mindanao (*Baker*).

Type.—Catalogue No. 24378, United States National Museum. Type male.

Allocynips isosceles sp. nov. Pl. 1, fig. 5.

Female.—Red. Head finely punctate. Median ridge on face developed only between antennæ. Facial line 0.84 transfacial, clypeus broadly emarginate. Interocular space 0.53 transfacial and area 1.0 times as broad as high. Malar space 0.48 eye. Antennæ 13-segmented, lengths as (scape) 19 : 8 : 12 (width 5) : 18 : 15 : 14 : 14 : 13 : 12 : 11 : 11 : 10 : 22 (width 9), flagellum gradually becoming stouter toward apex. Truncation of prothorax margined, as broad as sides which are coarsely punctate. Mesoscutum broader than long, with setigerous punctures in transverse rows, complete parapsidal grooves indicated. Scutellum 0.69 length of mesoscutum, disk with large umbilicate punctures, not margined or overhanging metanotum, pits at base smooth, circular, reaching 0.3 way back, separated by a thin

septum. Hind tarsus longer than tibia, metatarsus longer than 2–4 but shorter than 2–5. Wing subhyaline, radial cell closed, its veins clouded, 2.2 times as long as broad, first abscissa of radius arcuate and one-third length of second which is straight and equal to marginal with which it makes an angle of 25°. First cubital cell narrower at base. Surface brown pubescent, margin ciliate. Abdomen longer than thorax, height 0.63 and width 0.5 length, lengths of tergites measured along dorsal curvature as (petiole) 8 (width 23) : 31 : 16 : 19 : 53 : 19 : 8, all beyond 2 angled on median dorsal line and on hind margin when seen from above, tergite 5 microscopically punctate with a few hairs in middle on each side and more on anterior half of 6. Hypopygium very long, ventral spine hardly longer than broad, ventral valves not protruding. Using width of head as a base the length of mesonotum ratio is 1.06; antenna, 2.3; wing, about 2.2. Length, 3.6 millimeters.

Male.—Head red, rest of body dark reddish brown to nearly black. Antennæ 14-segmented, lengths as (scape) 16 : 6 : 10 : 17 : 16 : 16 : 15 : 15 : 14 : 14 : 13 : 13 : 12 : 19, all flagellar segments cylindrical, closely joined, tapering slightly toward tip. Hind metatarsus equal to 2–4 united. Abdomen slightly shorter than thorax, width and height about half length, lengths of tergites measured along dorsal curvature as (petiole) 11 (width 18) : 26 : 13 : 17 : 14 : 12 : 18, a row of hairs near dorsal front margin of 5, on front half of 6 and covering 7. In side view tergite 4 is the largest. Using width of head as a base the length of mesonotum ratio is 1.1; antenna, 3; wing, 2.9. Length, 2.7 to 2.9 millimeters.

Described from 1 female and 3 males collected at Singapore (*Baker*).

Type.—Catalogue No. 24379, United States National Museum. Type female and allotype.

Allocynips borneensis sp. nov. Plate 1, fig. 6.

Female.—Red to nearly black. Ocelli on prominent triangular elevation on frons bounded on sides by antennal grooves. Facial line 0.82 transfacial. Interocular space 0.57 transfacial and area 1.24 times as broad as high. Malar space 0.71 eye. Antennæ 13-segmented, lengths as (scape) 25 : 10 : 21 : 25 : 22 : 21 : 20 : 19 : 18 : 17 : 16 : 15 : 30. Truncation of pronotum margined, hind margin of pronotum forming a sharp rim which is higher than anterior part of adjacent mesoscutum but does not develop an erect median tooth. Mesoscutum broader than long,

parapsidal grooves complete, coarsely punctate in transverse rows. Scutellum not margined, disk punctate, two smooth pits at base. Hind tarsus longer than tibia, its metatarsus longer than 2–4 but shorter than 2–5, claws simple. Forewing dusky beyond basal, especially the radial cell which is 3.6 times as long as broad, first abscissa of radius slightly arcuate, one-third as long as second which meets the longer marginal at angle of 20°. Cubital reaching basal above middle. Abdomen longer than thorax, height 0.56 and width 0.34 length, lengths of tergites measured along dorsal curvature as (petiole) 10 (width 26) : 29 : 19 : 27 : 73 : 40, seventh not visible, all behind 2 angled along median dorsal line, tergites 5 and 6 microscopically punctate with larger setigerous punctures in middle on sides, ventral valves protruding horizontally. Using width of head as a base the length of mesonotum ratio is 1.1; antenna, 2.5; wing, 2.7. Length, 4 to 5 millimeters.

Described from specimens collected at Sandakan, Borneo (*Baker*).

Type.—Catalogue No. 24380, United States National Museum. Type female.

Allocynips flaviceps Kieffer.

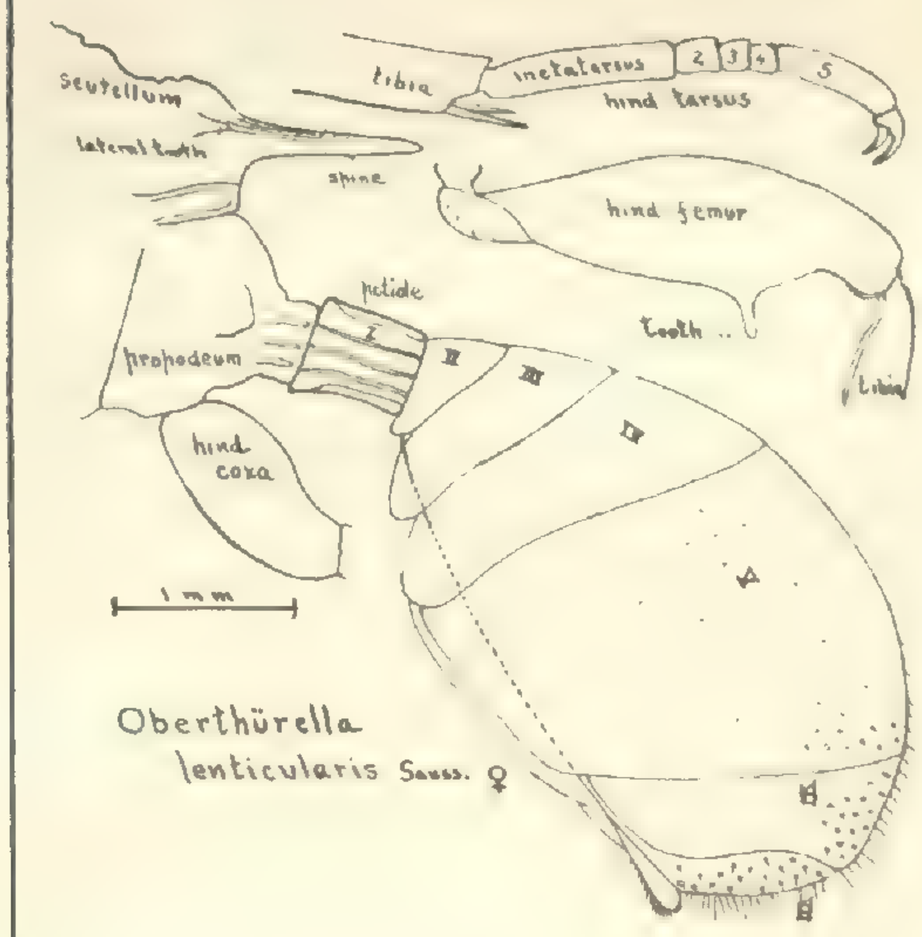
This, the second species to be included in the genus, was described in 1916[4] from a female from Mindanao. This species is included in the above key from characters given in the literature, as the location of the type is unknown to me.

[4] Philip. Journ. Sci. § D 11 (1916) 286.

ILLUSTRATIONS

Plate 1. Oriental Cynipidæ

Fig. 1. *Oberthürella lenticularis* Saussure; side view of scutellum and abdomen, hind femur, and tarsus.
2. *Paribalia borneana* sp. nov.; abdomen of female and male, and hind tarsus.
3. *Mesocynips insignis* Cameron; abdomen of male and front tarsus.
4. *Liopteron tarsale* Ashmead; side view of abdomen.
5. *Allocynips isosceles* sp. nov.; abdomen and part of forewing.
6. *Allocynips borneensis* sp. nov.; abdomen, wing, and antenna.



Oberthürella lenticularis Sauss. ♀

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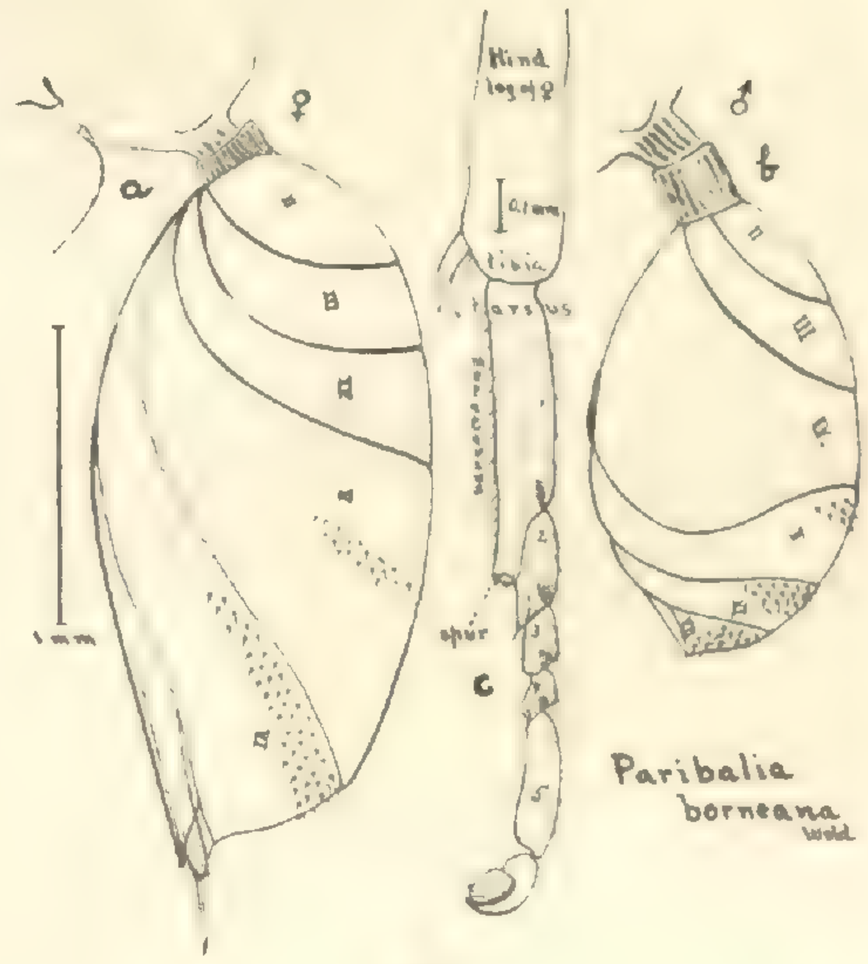

Paribalia borneana Weld

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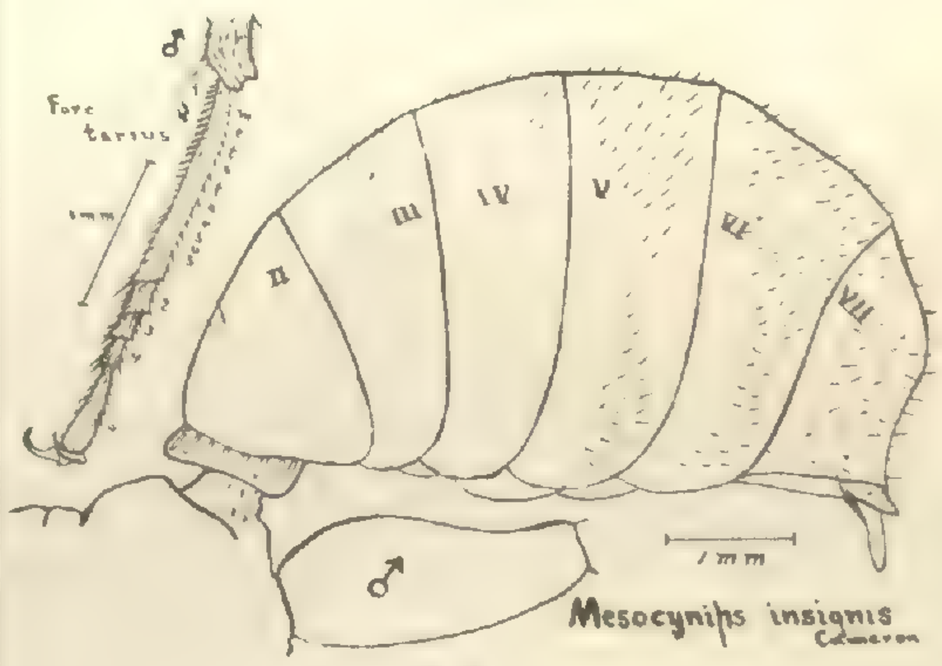

Mesocynips insignis Cameron

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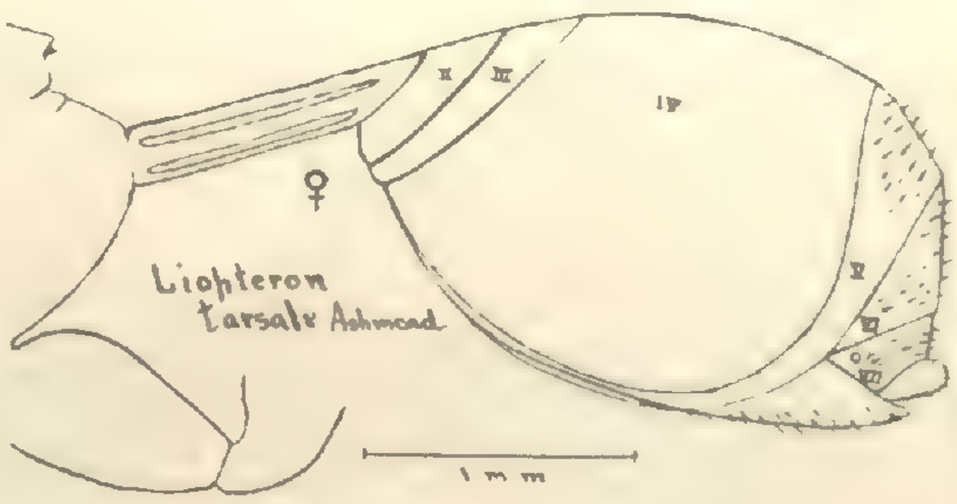

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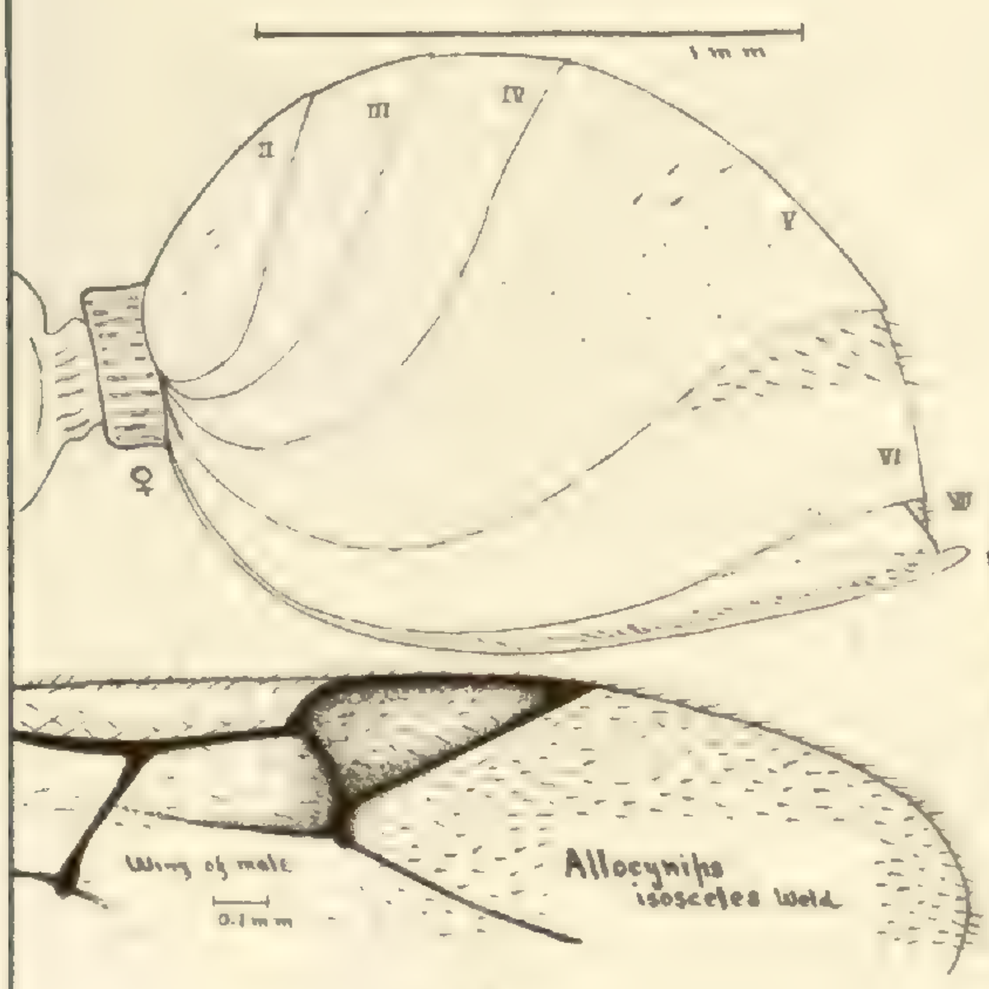

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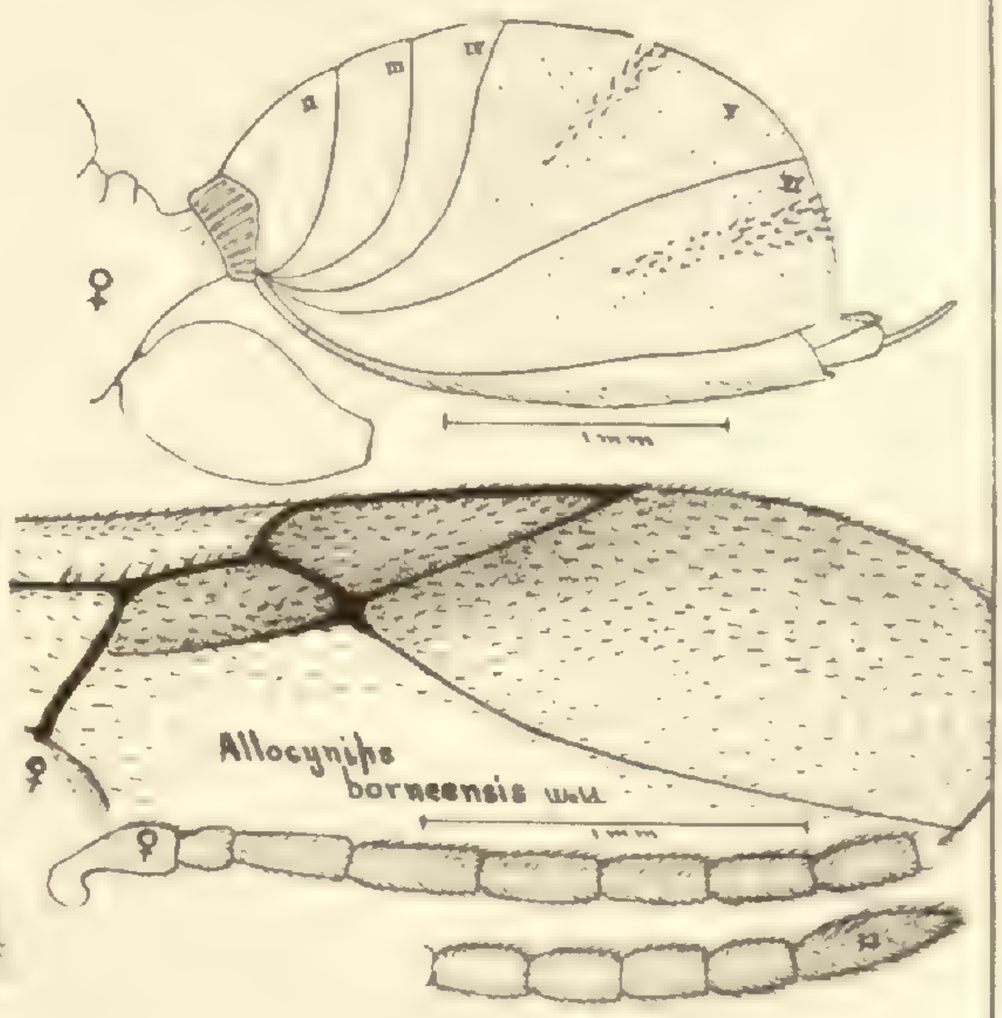

6

PLATE 1. ORIENTAL CYNIPIDÆ.

THE PHILIPPINE
JOURNAL OF SCIENCE

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DIAGNOSES OF HAINAN PLANTS

By ELMER D. MERRILL

Director and Botanist, Bureau of Science, Manila

The following diagnoses of presumably hitherto undescribed species of plants, totaling 37, are presented in connection with studies prosecuted in the past few months on an extensive series of specimens collected in Hainan by Mr. F. A. McClure, of the Canton Christian College. From collections made by former residents of, or visitors to, Hainan, Messrs. Bullock, Dahl, Delavay, Faber, Fagg, Hance, Hancock, A. Henry, B. C. Henry, Katsumada, Konishi, Lamont, and Swinhoe, about 350 species of plants in all groups have been credited to the island in botanical literature. The collections made by Mr. McClure, supplemented by smaller collections made by Miss Margaret M. Moninger and Miss K. L. Schaeffer, of the American Presbyterian Mission in Hainan, and Hainan material received from the Hongkong Botanic Garden in exchange, have enabled me to increase the list of known Hainan species from about 350 to about 1,025. It is thought, however, that considering the size and location of the island, its climatic conditions, altitudinal range, and the known rich floras of neighboring regions such as Formosa, northern Luzon, Kwangtung Province, and Indo-China, this number represents less than one-half, perhaps not more than one-third, of the species of plants that actually occur in Hainan.

ARACEAE

RHAPHIDOPHORA MACLUREI sp. nov.

Foliis coriaceis, integris, elliptico-ovatis, circiter 45 cm longis et 24 cm latis, acutis vel brevissime acuminatis, basi late rotundato-cordatis, leviter inaequilateralibus, nervis utrinque nume-

rosissimis; petiolo 26 ad 32 cm longo, circiter 1 cm diametro, fere ad apicem vaginato; spatha coriacea, lanceolata, acuminata, circiter 18 cm longa; spadix sessilis, cylindricus, circiter 2 cm crassus.

Ng Chi Leng, *McClure 8714*, December, 1921. Growing over large bowlders in ravines, altitude 600 meters.

A species probably most closely allied to the Philippine *R. monticola* Engl. and Krause, but with smaller leaves, much slenderer petioles, and much shorter spathes. It differs from the Javan *R. montana* Schott in its larger leaves, which are distinctly cordate at the base, and larger spathes.

LILIACEAE

1886 **DISPORUM HAINANENSE** sp nov.

Circiter 70 cm alta, haud ramosa; foliis membranaceis, ellipticis, abrupte et tenuiter acute acuminatis, 7 ad 10 cm longis, 3.5 ad 4.5 cm latis, nervis primariis 5; umbellis in axillis superioribus, brevissime (2 mm) pedunculatis, circiter 5-floris, pedicellis tenuibus, circiter 1.5 cm longis; floribus circiter 1 cm longis, perianthii segmentis oblongo-obovatis, abrupte breviter acuminatis, deorsum angustatis, basi leviter ventricosis, haud saccatis, margine ciliatis; filamentis 8 mm longis.

Ng Chi Leng, *McClure 8585*, December, 1921. On cliffs, altitude 800 meters, December 21, 1921, flowers yellow and maroon, fragrant.

Although my specimen is unbranched, I do not hesitate in placing it in the genus *Disporum*. It is characterized otherwise by its small flowers, not exceeding 1 cm in length, and by its perianth-segments being narrowed below and slightly ventricose but not saccate or spurred. To be compared with the material from Lofaushan, Kwangtung Province, referred with doubt by Dunn and Tutcher, after Hemsley, to *Disporum leschenaultianum* D. Don; it is certainly not Don's species, whatever else it may be.

ZINGIBERACEAE

1884 **ALPINIA MACLUREI** sp. nov. § *Catimbium, Boniophyton.*

Herba perennis circiter 1 m alta; foliis lanceolatis, 30 ad 40 cm longis, 4 ad 7 cm latis, caudato-acuminatis, subtus leviter pilosis, petiolo 1 ad 2 cm longo; paniculis erectis, angustis, 25 ad 35 cm longis, multifloris, uniformiter cinereo-pubescentibus; floribus circiter 5, confertis, sessilibus, pedunculo 1 ad 1.5 cm longo sustenti, bracteolae cylindraceo-cucullatae, fissae, deciduae,

8 mm longae, ovarium ovoideum, 1.5 ad 1.8 mm diametro, pubescente; calyx 1 cm longus, breviter latissime 3-dentatus, dentibus rotundatis, ciliato-laciniatis; corollae tubus 12 mm longus, lobis oblongis, cucullatis, 10 mm longis; labellum oblongo-ovatum, 12 mm longum, 6 ad 7 mm latum, sessile, deorsum bicarinatum, apice rotundatum; staminoidea lateralia 5 mm longa, tenera, corollae lobo postico adnata; filamentum 1.4 cm longum; fructibus globosis, glabris, 1 cm diametro, pericarpio fragile.

Nodoa, *McClure 7925*, in fruit, *8963* (type), in flower, October 27, 1921, and May, 1922. In thickets.

A species apparently allied to *Alpinia tonkinensis* Gagnep., presenting much in common with that species in its inflorescences, the flowers being subcapitately arranged at the apices of the primary branches; in its bracteoles; and in its staminodes being adnate to the upper corolla lobe. It differs in its sessile flowers, longer corolla tubes, much longer filaments, narrower, differently shaped lip, and in its leaves being somewhat pubescent beneath.

PIPERACEAE

4058 **PIPER MACLUREI sp. nov. § *Eupiper*.**

Frutex scandens, subglaber, ramis teretibus, olivaceis vel brunneis; foliis oblongis, chartaceis, in siccitate olivaceis vel brunneis, nitidis, 10 ad 16 cm longis, 3 ad 6 cm latis, breviter acuminatis, basi inaequilateraliter oblique cordatis, lobis rotundatis, in foliis junioribus imbricatis, penniverviis (vel basi plus minusve distincte 5-plinerviis), junioribus subtus leviter pubescentibus, nervis utrinque 6 vel 7, distantibus, curvato-anastomosantibus, perspicuis, petiolo 5 ad 10 mm longo; spicis ♂ breviter pedunculatis, circiter 10 cm longis, 4 mm diametro, bracteis peltatis, junioribus imbricatis, orbiculari-ellipticis, ciliatis, 1.5 mm diametro, filamentis 1.2 mm longis; racemis fructiferis circiter 10 cm longis, 1.5 cm diametro, fructibus liberis, numerosis, stipitatis, ellipsoideis, 4 ad 5 mm longis, pedicellis fructibus aequantibus.

Lo Tai, Namfung, and Ng Chi Leng, *Hongkong herb. 469*, April 27, 1893, in fruit, *McClure 8282, 8531* (type) with staminate flowers, November and December, 1921. In forested ravines, altitude 300 to 600 meters.

A species readily recognizable by its ciliate bracts, stipitate fruits, and inequilateral, distantly and pinnately nerved leaves, the basis being rounded and cordate on both sides of the midrib.

FAGACEAE

690 **CASTANOPSIS HAINANENSIS** sp. nov.

Arbor circiter 10 m alta, ramulis et subtus foliis minute puberulis; ramis teretibus, lenticellatis, fusco-cinereis, ramulis tenuibus, sulcatis; foliis coriaceis, oblongis ad oblongo-obovatis, 8 ad 12 cm longis, 3 ad 5 cm latis, basi acutis, apice obtusis vel rotundatis, margine distanter apiculato-serratis, supra in siccitate pallidis, glabris, subtus fusco-pallidis dense sed minutissime puberulis, nervis utrinque 10, perspicuis; petiolo circiter 1 cm longo; fructibus solitariis, globosis, usque ad 4 cm diametro, spinis numerosissimis rectis tenuibus subulatis parce tomentosis 1 cm longis fasciculatis obtectis; nuculis solitariis.

Between Namfung and Hong Ma Tsuen, *McClure 8300*, December 3, 1921. In thickets near villages, altitude 400 meters. Local name *yui muk*.

A species belonging in the group with *Castanopsis indica* DC. and *C. clarkei* King but differing in numerous characters. Among the Chinese species perhaps most closely allied to *C. jucunda* Hance. The very numerous spines entirely obscure the outside of the fruit, but are borne in fascicles which are either sessile or on very short tubercles. The pericarp is adherent to the involucre.

MORACEAE

2162 **FICUS PALMATILOBA** sp. nov. § *Eusyce*.

Frutex circiter 2 m altus, ramis teretibus, glabris, circiter 3 mm diametro, ramulis hispidis; foliis alternis, chartaceis, 12 ad 17 cm longis, profunde 3- vel 5-lobatis, lobis patulis, interioribus (3) anguste oblongis, 8 ad 12 cm longis, 1.5 ad 2 cm latis, exterioribus multo brevioribus, omnibus integris, acuminatis, basi rotundatis vel leviter cordatis, utrinque scaberulis; petiolo 3 ad 7 cm longo; receptaculis axillaribus, solitariis, sessilibus, globosis, 1 cm diametro, scabridis et parce ciliatis, bracteis 3, late triangulari-ovatis, acutis, 1.7 mm longis, leviter ciliatis; floribus ♂ numerosis, segmentis lanceolatis, 1.5 mm longis, staminibus 2 vel 1, antheris 1.5 mm longis; floribus cecidioferis in iisdem receptaculis, segmentis anguste lanceolatis, 2 mm longis, glabris, ovario ellipsoideo.

Nodoa, *McClure 8066*, November 3, 1921. In thickets, altitude about 250 meters.

A species in the group with *Ficus hirta* Vahl, differing however in very numerous characters, notably in its palmately 3- or 5-lobed leaves, the narrow central lobes attaining a length

of from 8 to 12 cm, and a breadth of from 1.5 to 2 cm, the outer two lobes, when present, much shorter and not exceeding 3 cm in length. The lobes other than the central one are all more or less divaricate.

URTICACEAE

DEBREGEASIA SPICULIFERA sp. nov.

Frutex 1.5 m altus, ramis ramulisque spiculis numerosis curvatis 2 ad 3 mm longis instructis; foliis chartaceis, ovatis, 7 ad 9 cm longis, 4.5 ad 6 cm latis, breviter acuminatis, basi rotundatis, serratis, supra olivaceis, scabridis, densissime punctiulatis, parce pubescentibus, subtus dense cinereo-pubescentibus, petiolo 1.5 ad 5 cm longo; cymis breviter pedunculatis, dichotomis, 1 ad 1.5 cm longis, usque ad 2 cm latis; capitulis paucis, globosis, sub fructu aurantiacis, 5 mm diametro; fructibus pyriformibus, 1.5 mm longis.

Ng Chi Leng, *McClure 8501,* December, 1921. In forested ravines, altitude 900 meters.

A species allied to *Debregeasia squamata* King of the Malay Peninsula, and like the latter characterized by the numerous 2 to 3 mm long, curved, spinelike spicules which are apparently soft when fresh. The spicules are not flattened however as in King's species, while the leaves are smaller.

ARISTOLOCHIACEAE

ARISTOLOCHIA HAINANENSIS sp. nov. § *Siphisia.*

Frutex scandens, 3 m altus, caulis valde rugosis, 1 cm diametro; foliis coriaceis, ovatis ad elliptico-ovatis, 12 ad 15 cm longis, 8 ad 10 cm latis, obtusis, basi truncato-rotundatis, supra olivaceis, glabris, vel ad costa nervisque pilosis, subtus dense pallide pilosis, nervis utrinque plerumque 3, adscendentibus, anastomosantibus, perspicuis; petiolo 4 ad 6 cm longo; inflorescentiis caulinis, racemosis, paucifloris, floribus longe pedicellatis, flavidis, sordide denseque villosis, intus glabris; perianthium refractum, tubus cylindraceo-ovoideus, 8 mm longus, in labium refractum rhomboideo-ovatum crassum obtusum villosum usque ad 1.4 cm longum basi angustatum producto, labio 8 mm lato; columna stylina 3 mm longa, 3-lobata, antheris 6, per paribus approximatis.

Ng Chi Leng, *McClure 8630.* In forests, altitude about 1,300 meters.

A species strongly characterized by its coriaceous, ovate to elliptic-ovate, entire leaves which are truncate-rounded at the base, glabrous or nearly so above and densely pale-villous be-

neath, as well as by its cauline, racemose inflorescences and densely villous flowers, the perianth being 1-lipped and strongly refracted. The axis of the racemes is up to 3 cm long, the bracts small, densely pubescent, about 2 mm long.

ANONACEAE

2747 **FISSISTIGMA MACLUREI sp. nov.**

Frutex scandens, partibus junioribus et floribus et subtus foliis villosis; ramis teretibus, lenticellatis, glabris, atro-brunneis, ramulis ferrugineo-villosis; foliis subcoriaceis, lanceolatis ad oblongo-lanceolatis, 7 ad 12 cm longis, 1.5 ad 4 cm latis, basi obtusis ad subacutis, apice acutis vel acuminatis, supra olivaceis, glabris, subtus pallidioribus, molliter villosis, nervis utrinque 13 ad 17, perspicuis, subparallelis, adscendentibus; petiolo villoso, 5 ad 8 mm longo; floribus axillaribus, solitariis, breviter (ca. 5 mm) pedicellatis, ovoideis, 12 ad 15 mm longis; sepalis oblongis, 5 mm longis, cum petalis exterioribus extus dense atro-purpureo-villosis; petalis crasse coriaceis, exterioribus oblongo-ovatis, usque ad 1.4 cm longis et 8 mm latis, obtusis, interioribus utrinque glaberrimis, usque ad 11 mm longis et 5 mm latis, obtusis; antheris numerosis, oblanceolatis, 2 mm longis; carpellis numerosis, adpresse villosis, 2 mm longis, ovulis circiter 6; stylo oblongo-cylindrico, 1.2 mm longo.

Ng Chi Leng, *McClure 8420, 8460* (type), *8512,* December, 1921. In forested ravines, altitude 600 to 1,200 meters.

In many characters this species resembles *Fissistigma* (*Melodorum*) *oldhamii* Merr. but is not closely allied to that species, differing notably in its acute leaves and entirely glabrous inner petals. The flowers are described by McClure as being black outside and maroon and yellow inside.

LAURACEAE

2746 **MACHILUS HAINANENSIS sp. nov.**

Frutex vel arbor parva (3 m alta fide McClure), ramulis et inflorescentiis et subtus foliis ferrugineo-villosis; ramis ferrugineo-pubescentibus, glabrescentibus, teretibus, 4 ad 5 mm diametro, ramulis dense ferrugineo-villosis; foliis plus minusve confertis, obovatis ad oblongo-obovatis, coriaceis, 10 ad 15 cm longis, 4 ad 9 cm latis, breviter acuminatis, deorsum angustatis, basi acutis, supra subolivaceis, nitidis, glabris vel costa nervisque pubescentibus, subtus pallidioribus ad costa nervisque dense ferrugineo-pubescentibus, nervis utrinque 5 ad 6, adscendentibus, perspicuis; petiolo dense ferrugineo-pubescente, 1 ad 2.5 cm longo; paniculis axillaribus, usque ad 7 cm longis, dense ferru-

gineo-villosis, multifloris, floribus in ramulis ultimis umbellatim dispositis; perianthii segmentis ellipticis, rotundatis, 4 mm longis, pubescentibus; filamentis dense villosis, antheris 2 mm longis, filamentis aequantibus, glandulis subsessilibus; ovario villoso.

Mai Deng and Nodoa, *McClure 7957* (type), *7674*, October and November, 1921. In thickets, altitude about 250 meters. Local name *pau fa*.

This species is apparently most closely allied to *Machilus velutina* Champ. differing in its much longer inflorescences, fewer-nerved, less-pubescent leaves, longer petioles, and numerous other characters.

PHOEBE HAINANENSIS sp. nov.

Arbor glabra, circiter 8 m alta, ramulis leviter sulcatis, circiter 4 mm diametro; foliis plus minusve confertis, subcoriaceis, lanceolatis ad oblanceolatis vel oblongo-oblanceolatis, 17 ad 28 cm longis, 4.5 ad 7 cm latis, utrinque subaequaliter angustatis, apice subcaudato-acuminatis, basi cuneatis, supra subolivaceis, nitidis, subtus paullo pallidioribus, nervis utrinque 9 ad 11, adscendentibus, subtus perspicuis; petiolo 2.5 ad 4 cm longo; inflorescentiis 13 ad 17 cm longis, longe pedunculatis, paucifloris; perianthii segmentis ovatis, obtusis, coriaceis, glabris, 4 mm longis; fructibus junioribus oblongis, obtusis, usque ad 1.7 cm longis, circiter 8 mm diametro.

Ng Chi Leng, *McClure 8589*, December 21, 1921. In forested ravines, altitude 700 meters.

The present species is allied to *Phoebe cuneata* Blume and *P. lanceolata* Nees, among other characters being easily distinguished from both by its longer leaves and much longer petioles, and from the former by being quite glabrous.

CRYPTOCARYA HAINANENSIS sp. nov.

Arbor circiter 15 m alta, inflorescentiis exceptis glabra, ramulis tenuibus, castaneis vel nigricantibus; foliis penninerviis, lanceolatis ad oblongo-lanceolatis, subcoriaceis, acuminatis, basi acutis, in siccitate olivaceis, utrinque concoloribus vel subtus paullo pallidioribus, 9 ad 11 cm longis, 2 ad 3 cm latis, nervis utrinque circiter 6, subtus perspicuis, curvato-adscendentibus, pagina inferiore distincte foveolatis; floribus ignotis; fructibus ellipsoideis vel obovoideis, in siccitate nigricantibus, circiter 2.5 cm longis, 1.5 ad 2 cm diametro, glabris, nitidis, leviter rugosis, obscure longitudinaliter sulcatis.

Ng Chi Leng, *McClure 8707*, December 20, 1921. On forested slopes, altitude 700 meters, known to the Lois as *chai kan koon*.

A species characterized by its narrow, lanceolate to oblong-lanceolate, concolorous, glabrous leaves and its rather large obovoid to subellipsoid, glabrous, rugose, and slightly longitudinally sulcate fruits.

2206

CRYPTOCARYA MACLUREI sp. nov.

Arbor circiter 20 m alta, partibus junioribus puberulis; ramis ramulisque teretibus, tenuibus, puberulis; foliis penniverviis, glabris, chartaceis vel subcoriaceis, oblongis ad oblongo-ovatis, 8 ad 10 cm longis, 3 ad 4 cm latis, acuminatis, basi acutis, supra olivaceis, nitidis, subtus pallidis vel albicantibus, nervis utrinque circiter 7, subtus perspicuis, pagina inferiore haud foveolatis; fructibus globosis vel depresso-globosis, glabris, laevis, 1.5 cm diametro, in siccitate nigricantibus, haud sulcatis.

Ng Chi Leng, *McClure 8508*, December 22, 1921. In forested ravines, altitude 1,000 meters.

A species probably as closely allied to *Cryptocarya caesia* Blume as to any other described form, but with globose fruits and shorter, fewer-nerved leaves which are often nearly white beneath.

2215

CRYPTOCARYA OBTUSIFOLIA sp. nov.

Arbor circiter 10 cm alta, partibus junioribus et inflorescentiis et subtus foliis ad costa nervisque ferrugineo-pilosis, ramis ultimis 3 mm diametro, glabris, griseis vel brunneis, foliis crasse coriaceis, penninerviis, oblongo-ellipticis, 13 ad 19 cm longis, 4.5 ad 7 cm latis, apice rotundatis, basi acutis; supra in siccitate flavido-viridis, subtus glaucescentibus, nervis utrinque circiter 9, supra impressis, subtus cum reticulis valde perspicuis, haud foveolatis; petiolo pubescente, 10 ad 12 mm longo; paniculis 14 cm longis, ferrugineo-pubescentibus, ramis paucis, inferioribus 5 ad 6 cm longis; fructibus submaturis ellipsoideis, 10 ad 12 mm longis, glabris vel apice leviter pubescentibus, in siccitate nigricantibus, obscure longitudinaliter 12-costatis.

Ng Chi Leng, *McClure 8581*, December 21, 1921. In forested ravines, altitude 700 meters.

A species resembling *Cryptocarya crassinervia* Miq. in many respects. To be compared with *Cryptocarya ochracea* H. Lecomte of Indo-China, but with rounded leaves and longer petioles.

ROSACEAE

2230

RHAPHIOLEPIS PARVIBRACTEOLATA sp. nov.

Frutex 2.5 m altus, inflorescentiis parcissime villosis exceptis glaber; ramis ramulisque tenuibus, glabris; foliis ellipticis,

coriaceis, 4 ad 5 cm longis, 2 ad 3 cm latis, glaberrimis, acutis vel obtusis, basi cuneatis, margine crenato-serratis; inflorescentiis circiter 6 cm longis, corymboso-paniculatis, parcissime ferrugineo-villosis, glabrescentibus, bracteis bracteolisque anguste lanceolatis, glabris, acuminatis, 2 ad 3 mm longis; floribus circiter 1.5 cm diametro, sepalis oblongis, acutis, 2 ad 2.3 mm longis, glabris vel margine leviter villosis, calycis tubo plus minusve 5-angulato; petalis obovatis, 7 mm longis, glabris.

Nodoa, *McClure 8015,* January 2, 1922. In thickets along roads, altitude 250 meters, the flowers white, fragrant.

This specimen differs so radically from typical *Rhaphiolepis indica* Lindl. in its nearly glabrous inflorescences and calyces, and especially in its very short glabrous bracts and bracteoles that I cannot see how it can be referred to Lindley's species; nor does it appear to be referable to any of the described forms reduced by Hemsley to *R. indica* Lindl.

LEGUMINOSAE

BAUHINIA MONINGERAE sp. nov. § *Phanera.*

Frutex ut videtur scandens, ramulis et inflorescentiis dense castaneo- vel ferrugineo-pubescentibus, ramis tenuibus, glabris; foliis ovatis, in siccitate castaneis, chartaceis vel subcoriaceis, 6 ad 8 cm longis, 4 ad 7 cm latis, basi 9-nerviis, cordatis, lobis rotundatis, apice bifidis, usque ad $\frac{1}{3}$ vel $\frac{1}{2}$ divisis, lobis obtusis, imbricatis, supra glabra, subtus ad nervis castaneo-pubescentibus; petiolo 3 ad 5 cm longo, castaneo-pubescente; racemis terminalibus 7 ad 13 cm longis; floribus albidis, 4 ad 5 cm diametro, calycis lobis oblongo-lanceolatis, acuminatis, reflexis, dense villosis, 10 ad 12 cm longis, quam tubo tenue paullo longioribus; petalis obovatis, 2 ad 2.5 cm longis, usque ad 1.8 cm latis, rotundatis, basi acutis, extus ferrugineo-villosis; staminibus 3, filamentis basi villosis, sursum glabris, 1.7 cm longis; antheris anguste oblongis, 6 mm longis; ovario densissime ferrugineo-villoso. Pedicellis tenuibus, 4 ad 6 cm longis, bracteis bracteolisque filiformibus, 3 ad 4 mm longis.

Loh-hoe, *Moninger 160,* May, 1919. In forests.

A species well characterized by its large white flowers, the obovate petals being densely villous externally, its long pedicels, filiform bracteoles, and cordate castaneous leaves. The calyx tubes are very slender, and the sepals are reflexed in anthesis. The buds are oblong-ellipsoid, 1 cm long or less, and obtuse. It apparently belongs in the group with *Bauhinia polystachya* Gagnep.

RUTACEAE

EVODIA HAINANENSIS sp. nov.

Arbor parva (4 m alta fide McClure), partibus junioribus leviter hirsutis; ramis teretibus, glabris, rubro-brunneis, circiter 3 mm diametro, parcissime lenticellatis, ramulis leviter hirsutis; foliis pinnatis, 25 ad 35 cm longis, foliolis 9, membranaceis, oblongo-lanceolatis, tenuiter obtuse acuminatis, basi acutis, superioribus 11 ad 15 cm longis, 2.5 ad 4 cm latis, inferioribus brevioribus, nervis utrinque 9 ad 15, patulis, curvatis, distinctis, anastomosantibus, reticulis laxis, obscuris, supra olivaceis, subglabris, vel ad costa pubescentibus, subtus perspicue atro-glandulosis, ad costa leviter hirsutis, petiolulis circiter 3 mm longis; cymis terminalibus, circiter 7 cm longis et latis, trichotomis, leviter hirsutis; coccis plerumque 4, obovoideis, 5 mm longis, brevissime apiculatis, leviter rugosis, obscure glandulosis.

Ng Chi Leng, *McClure 8449*, December 7, 1921. On slopes, altitude about 1,000 meters, known to the Lois as *ngau tau shue*.

A species belonging in the group with *Evodia rutaecarpa* Hook. f. & Th., well characterized by its differently shaped, narrower, nearly glabrous leaflets, and its short inflorescences.

EUPHORBIACEAE

BREYNIA ROSTRATA sp. nov.

Frutex vel arbor parva, glabra, ramis ramulisque teretibus, laevis, in siccitate atro-brunneis; foliis chartaceis vel subcoriaceis, rigidis, oblongo-ovatis, 2 ad 3 cm longis, 1 ad 1.5 cm latis, basi acutis ad obtusis, apice acuminatis, in siccitate atro-olivaceis, utrinque concoloribus vel subtus leviter pallidioribus, nervis utrinque 4 vel 5, tenuibus, arcuato-anastomosantibus, obscuris, supra plerumque leviter impressis, secondariis obsoletis; petiolo circiter 2 mm longo; stipulis lanceolatis, acuminatis, petiolo subaequantibus; calycis circiter 6 mm diametro, sepalis majoribus orbiculari-ovatis, minoribus leviter anguste ovatis, leviter accrescentibus, sub fructu reflexis; fructibus globosis, glabris, laevis, circiter 7 mm diametro, perspicue rostratis.

Ng Chi Leng, *McClure 8516*, December 22, 1921. In forested ravines, altitude 900 meters.

A species much resembling *Breynia fruticosa* Hook. f. in its general appearance, distinguished however by its very strongly reflexed calyx segments and its prominently rostrate fruits, the stout rostrum about 2 mm long, formed by the persistent styles.

2938 **ANTIDESMA HAINANENSE** sp. nov.

Frutex 1.5 m altus, ramulis sordide pubescentibus, ramis teretibus, cinereis, glabris; foliis chartaceis, oblongis ad oblongo-lanceolatis, 10 ad 15 cm longis, 3 ad 4 cm latis, olivaceis, nitidis, supra costa excepta glabris, subtus ad costa nervisque pilosis, apice perspicue acuminatis apiculatisque, basi acutis, nervis utrinque circiter 7, distantibus, arcuato-anastomosantibus, supra impressis, subtus cum reticulis primariis laxis valde perspicuis; stipulis filiformibus, usque ad 5 mm longis, pilosis; petiolo dense pubescente, 4 ad 8 mm longo; racemis fructiferis axillaribus, solitariis, 3 cm longis, perianthii segmentis 4, oblongo-lanceolatis, acuminatis, 1 mm longis, pubescentibus; fructibus obovoideis vel suborbicularis, compressis, 7 ad 8 mm longis, obtusis, glabris, leviter rugosis, pedicellis circiter 1 mm longis, bracteolis persistentibus, petiolo subaequantibus.

Ng Chi Leng, *McClure 8702,* December 20, 1921. On forested slopes, altitude 700 meters.

A form first identified by me with *Antidesma apiculatum* Hemsl. but differing from that species in very numerous characters, notably in its smaller, fewer-nerved leaves which are pilose on the nerves beneath, shorter pedicels, much shorter racemes, and differently shaped fruits.

2939 **MALLOTUS MACLUREI** sp. nov. § *Axenfeldia.*

Frutex circiter 1.5 cm altus, ramis teretibus, glabris, ramulis obscure puberulis; foliis suboppositis, in paribus inaequimagnis, haud granulari-glandulosis, chartaceis, in siccitate pallidis, supra glabris, subtus ad costa leviter pilosis, subcaudato-acuminatis, deorsum leviter angustatis, basi truncato-rotundatis vel subcordatis, nervis utrinque 7 vel 8, perspicuis, irregulariter dentatis, foliis majoribus usque ad 13 cm longis et 4.5 cm latis, minoribus 6 cm longis et 2 cm latis; petiolo foliis majoribus 1 ad 2 cm longo; infructescentiis simplex, racemosis, circiter 6 cm longis, capsulis 10 ad 12 mm diametro, granulari-glandulosis, echinatis, echinis sparsis, submollis, 2 ad 3 mm longis, curvatis, glabris.

Ng Chi Leng, *McClure 8558,* December 20, 1921. In forested ravines, altitude 600 meters.

This species is allied to *Mallotus esquirolii* Lév. from which it differs in its smaller leaves which are not strictly opposite, and which are truncate-rounded or even slightly cordate at the base. The capsules are not densely echinate, the spines being distinctly scattered.

ICACINACEAE

228 **GOMPHANDRA HAINANENSIS** sp. nov.

Frutex vel arbor parva, ramulis junioribus exceptis glabra; ramis teretibus, cinereis, in siccitate rugosis, 2 ad 3 mm diametro, glabris, ramulis adpresse subferrugineo-pubescentibus; foliis glaberrimis, membranaceis vel subchartaceis, anguste oblongis, olivaceis, nitidis, 9 ad 14 cm longis, 2 ad 3 cm latis, obtuse acuminatis, basi acutis, nervis utrinque 5 ad 8, valde distantibus, supra subobsoletis, subtus distinctis, arcuato-anastomosantibus, reticulis laxis; petiolo 1 cm longo; fructibus oblongo-ellipsoideis, obtusis, leviter inaequilateralibus, circiter 13 mm longis et 7 mm diametro, pedicellatis, pedicellis 3 mm longis.

Ng Chi Leng, *McClure 8546*, December 20, 1921. On forested slopes, altitude about 700 meters.

This is apparently most closely allied to *Gomphandra cambodiana* Pierre, from which it differs in its entirely glabrous leaves and its conspicuously arched marginal nerves.

229 **GONOCARYUM MACLUREI** sp. nov.

Arbor parva, glabra, ramulis tenuibus, olivaceis, 2 mm diametro; foliis coriaceis, oblongis ad oblongo-ellipticis, olivaceis, nitidis, 7 ad 10 cm longis, 3 ad 4.5 cm latis, brevissime obtuse acuminatis vel obtusis, basi obtusis ad late acutis, nervis utrinque 5 vel 6, distantibus, tenuibus, obscure arcuato-anastomosantibus, reticulis obscuris; petiolo circiter 1 cm longo; fructibus ellipsoideis vel oblongo-ellipsoideis, laevis, nitidis, in siccitate nigris, 3 ad 4 cm longis, 1.8 ad 2.4 cm diametro, apice leviter depressis apiculatisque.

Ng Chi Leng, *McClure 8606*, December 16, 1921. On partly forested slopes, altitude 700 meters.

The first representative of the genus to be found in China, its alliance being with *Gonocaryum subrostratum* Pierre and more especially with *G. harmandianum* Pierre, from both of which it is distinguished by its smaller, differently shaped leaves.

SABIACEAE

230 **MELIOSMA ANGUSTIFOLIA** sp. nov.

Arbor parva, circiter 5 m alta, inflorescentiis exceptis glabra, ramulis ultimis 7 mm diametro; foliis pinnatis, circiter 25 cm longis, foliolis circiter 19, lanceolatis, integris, coriaceis, 5 ad 8 cm longis, 1.5 ad 2 cm latis, utrinque subaequaliter angustatis, acute acuminatis, basi acutis, leviter inaequilateralibus, supra pallide olivaceis, nitidis, subtus pallidioribus, nervis utrinque 8 ad 10, obscuris, arcuato-anastomosantibus, petiolulis 5 ad 7 mm

longis; paniculis terminalibus, erectis, pedunculatis, foliis aequantibus, ramis primariis 5 ad 6 cm longis, patulis vel adscendentibus, rigidis, plus minusve hirsutis; fructibus globosis vel obovoideis, 4 ad 5 mm longis, glabris, breviter pedicellatis.

Ng Chi Leng, *McClure 8507*, December 22, 1921. In forested ravines, altitude 950 meters.

A species strongly characterized by its narrow, lanceolate, entire, sharply acuminate, obscurely nerved leaflets.

RHAMNACEAE

1129 **RHAMNELLA HAINANENSIS sp. nov.**

Frutex glaber, vel ramulis junioribus parcissime pubescentibus, circiter 3 m altus, ramis teretibus, tenuibus, in siccitate pallidis, ramulis olivaceis, vix 1 mm diametro; foliis chartaceis, oblongo-ellipticis, 3.5 ad 8 cm longis, 1.5 ad 3.4 cm latis, deorsum integris, sursum obscure serrulatis, nitidis, pallide olivaceis, basi late acutis ad subrotundatis, apice distincte et plerumque obtuse acuminatis, nervis utrinque 5, tenuibus, distinctis; petiolo 3 ad 5 mm longo; fructibus plerumque solitariis, oblongo-ovoideis, 1-locularis, circiter 1 cm longis et 5 mm diametro, acutis; pedicellis circiter 8 mm longis.

Ng Chi Leng, *McClure 8358*, December 6, 1921. In shaded ravines, altitude about 800 meters.

Among the six hitherto known representatives of this genus the present species seems to be nearest to *Rhamnella wilsonii* Schneider.

PASSIFLORACEAE

1681 **ADENIA MACLUREI sp. nov.**

Suffruticosa, scandens, glabra, ramis in siccitate pallidis, 2 ad 3 mm diametro, leviter striatis; foliis chartaceis, oblongis, integris, pallide olivaceis, utrinque concoloribus nitidisque, 10 ad 12 cm longis, 4.5 ad 6 cm latis, subacutis ad obscure acuminatis, basi late acutis ad subrotundatis, auriculato-glandulosis, nervis utrinque plerumque 4, distinctis, anastomosantibus, reticulis laxis, petiolo 2 ad 2.5 cm longo; cirrhis rigidis, 5 ad 6 cm longis; fructibus anguste ellipsoideis, circiter 8 cm longis, 3-valvis, nitidis, laevis, basi acutis, apice obtusis, solitariis, pedunculo 5 ad 6 cm longo; seminibus circiter 8 mm longis, compressis, rugosis.

Notia, *McClure 8242*, October 27, 1921. In dry thickets.

The special characters of this species are its oblong, subacute, noncordate, entire leaves. It belongs in the group with *Adenia acuminata* (Blume) King.

MYRTACEAE

7357. **EUGENIA MACLUREI** sp. nov. § *Syzygium.*

Frutex glaber, 2 m altus, ramis tenuibus, teretibus, ramulis 1 mm diametro, angulatis; foliis oblongis ad oblongo-ellipticis, chartaceis, olivaceis, 2 ad 4 cm longis, 0.5 ad 1.5 cm latis, utrinque subaequaliter angustatis, basi acutis, apice obtusis vel obscure obtuse acuminatis, supra minutissime puncticulatis, costa impressa, subtus paullo pallidioribus, nervis utrinque numerosis, tenuibus, obscuris, primariis quam secundariis vix magis distinctioribus; petiolo 1 mm longo; inflorescentiis axillaribus terminalibusque, quam foliis brevioribus, paucifloris, racemosis vel subumbellatis, breviter pedunculatis; floribus circiter 1 cm longis, brevissime pedicellatis, calycis circiter 8 mm longis, truncatis, teretibus, apice circiter 3 mm diametro, deorsum gradatim angustatis; filamentis brevibus, petalis calyptratim connatis, deciduis, calyptra circiter 3 mm diametro.

Taai Uen, *McClure 7678*, October 26, 1921. In dry thickets.

A species belonging apparently in the group with *Eugenia fluviatilis* Hemsl. but with smaller leaves and very differently shaped flowers.

ERICACEAE

4416 **RHODODENDRON HAINANENSE** sp. nov.

Frutex erectus, multiramosus, ramulis fastigiatis, adpresse hirsutis; foliis linearis ad lineari-lanceolatis, confertis, 1.5 ad 2 cm longis, circiter 3 mm latis, subcoriaceis, utrinque subaequaliter angustatis, basi cuneatis, apice acutis vel leviter acuminatis, supra subolivaceis, subtus glaucescentibus, utrinque pilis paucis albidis instructis, nervis utrinque 3 vel 4, tenuibus; floribus depauperato-fasciculatis, 3 cm longis, purpureis, pedicellis hirsutis; calycis lobis 5, ellipticis ad elliptico-ovatis, 3 mm longis, rotundatis, ciliatis; corolla glabra, vel deorsum utrinque puberula, lobis subaequalibus, 1.5 cm longis, tubo subaequantibus; staminibus 10, filamentis deorsum cinereo-pubescentibus, inaequalibus; ovario dense piloso; capsulis ovoideis, 6 mm longis, valvis incrassatis, rectis, vetustioribus glabris.

Hainan, *Miss K. L. Schaeffer*, January, 1921. On rocks along streams in the eastern part of the island.

A species apparently belonging in the group with *Rhododendron simsii* Planch., strongly differentiated, however, by its very narrow leaves which are distinctly glaucous beneath.

MYRSINACEAE

1915 **ARDISIA MACLUREI** sp. nov. § *Bladhia.*

Suffruticosa, haud ramosa, repens, caulis 4 ad 15 cm longis, radicans, rugosis, 2 mm diametro, deorsum glabris, sursum villosis; foliis alternis vel superioribus subverticillatis, oblongo-obovatis ad oblongo-ellipticis, olivaceis, 4 ad 6 cm longis, 2 ad 3 cm latis, obtusis, basi cordatis, irregulariter dentatis, utrinque pilis paucis articulatis elongatis instructis, costa utrinque dense subfurfuraceo-villosis, nervis utrinque 9 ad 12, cum reticulis distinctis; petiolo dense villoso, 5 ad 10 mm longo; inflorescentiis subterminalibus, subumbellatis, villosis, pilis numerosis articulatis patulis subfurfuraceis instructis, pedunculo circiter 4 cm longo; floribus paucis, plerumque 2 vel 3, bracteolis linearis ad anguste lanceolatis, 3 ad 5 mm longis, pedicellis 5 ad 7 mm longis, villosis; sepalis anguste lanceolatis, 3 ad 4 mm longis, plus minusve ciliatis; fructibus globosis, 6 mm diametro, glabris.

Ng Chi Leng, *McClure 8668,* December 15, 1921. In forested ravines, altitude 1,200 meters.

A very strongly marked species of the section *Bladhia,* distinguished at once from all hitherto described forms by its cordate leaves.

SAPOTACEAE

1438 **SIDEROXYLON ROSTRATUM** sp. nov.

Arbor circiter 10 m alta, floribus exceptis glaberrima, ramis ramulisque teretibus, tenuibus, ramis lenticellatis; foliis chartaceis, oblongo-ellipticis, 10 ad 15 cm longis, 4.5 ad 5 cm latis, olivaceis, nitidis, subtùs pallidioribus, glaberrimis, utrinque subaequaliter angustatis, basi acutis, apice acuminatis, nervis utrinque 8 ad 10, distinctis, arcuato-anastomosantibus, reticulis laxis; petiolo 1 ad 1.5 cm longo; floribus junioribus ferrugineo-pubescentibus, paucis, axillaribus; fructibus ovoideis, circiter 3.5 cm longis, 2 cm diametro, minute subferrugineo-pubescentibus glabrescentibus, perspicue rostratis, sepalis persistentibus, circiter 3 mm longis, subglabris.

Ng Chi Leng, *McClure 8559,* December 20, 1921. In forested ravines along streams.

A species well characterized by being entirely glabrous except the flowers (buds) and fruits, and in its rostrate fruits. It resembles the Philippine *Sideroxylon villamilii* Merr. in its vegetative characters but has very different fruits.

EBENACEAE

DIOSPYROS CARDIOPHYLLA sp. nov.

Frutex vel arbor parva, ramulis et subtus foliis perspicue ferrugineo-villosis, ramis teretibus, glabris, ramulis atro-brunneis; foliis brevissime petiolatis, subcoriaceis, olivaceis, nitidis, oblongo-ovatis ad oblongo-ellipticis, 8 ad 10 cm longis, 2.5 ad 4.5 cm latis, basi late rotundatis, distincte cordatis, apice acuminatis, supra glabris, nervis distincte impressis, subtus perspicue ferrugineo-villosis praesertim ad costa nervisque, nervis utrinque circiter 10, adscendentibus, perspicuis, curvato-anastomosantibus; petiolo 2 ad 4 mm longo; floribus axillaribus, solitariis, sessilibus, sepalis persistentibus, lanceolatis, acuminatis, 7 mm longis, chartaceis, extus dense ferrugineo-villosis; fructibus ovoideis, brunneis, nitidis, parce villosis, 10 ad 12 mm longis, subacutis, 1-locellatis, 1-spermis, albumine aequabile.

Ng Chi Leng, *McClure 8349*, December, 1921. On slopes, altitude 650 meters.

A species resembling in many characters *Diospyros eriantha* Champ. and manifestly allied to it. It is at once distinguishable by its longer, more-numerously nerved, cordate leaves which are conspicuously ferruginous-villous beneath.

APOCYNACEAE

WRIGHTIA HAINANENSIS sp. nov.

Arbor parva, floribus exceptis glaberrima; foliis lanceolatis ad oblongo-lanceolatis vel oblongis, 8 ad 13 cm longis, 1.5 ad 4.5 cm latis, caudato-acuminatis, basi acutis, chartaceis, olivaceis, nitidis, nervis utrinque 5 vel 6, curvato-adscendentibus, distinctis; cymis paucifloris, brevibus, floribus albidis; calycis segmentis orbiculari-ovatis, 1 mm longis, corollae tubo brevioribus; petalis ellipticis ad elliptico-oblongis, 1 cm longis, utrinque puberulis, squamis coronae 25, filiformibus, glabris, 3 ad 4 mm longis; antheris lanceolatis, pubescentibus, 5 mm longis; folliculis circiter 35 cm longis, 7 mm diametro, lenticellatis.

Ng Chi Leng, Kai Fong, and Fong Mok Szee, *Hongkong herb. 425* (type), *446*, *McClure 8685*. In forested ravines.

The first specimen cited, in flower, was distributed as a *Rauwolfia;* the second, in fruit, as a *Villaris*. McClure's specimen, in fruit, was from forested ravines, altitude 750 meters. The species is well characterized by being entirely glabrous, except for its puberulent flowers; by its elongated follicles; and by its corona being divided into 25 filiform, glabrous, subequal segments. It belongs in the group with *Wrightia laevis* Hook. f.

CONVOLVULACEAE

ERYCIBE HAINANENSIS sp. nov.

Frutex scandens, circiter 10 m altus, ramis teretibus, circiter 5 mm diametro, dense castaneo-villosis; foliis chartaceis ad subcoriaceis, ellipticis ad oblongo-ellipticis, 15 ad 18 cm longis, 6 ad 8 cm latis, perspicue acuminatis, basi obtusis ad subrotundatis, utrinque subconcoloribus, pallide olivaceis, nitidis, supra glabris, puncticulatis, costa impressa, subtus ad costa dense ferrugineo-villosis ceteroquin leviter villosis, nervis utrinque circiter 9, reticulis laxis, vix conspicuis; petiolo densissime villoso, circiter 1 cm longo; inflorescentiis subracemosis, axillaribus terminalibusque, densissime ferrugineo-villosis, usque ad 12 cm longis; fructibus ellipsoideis, glabris, circiter 2 cm longis, in siccitate nigris, sepalis persistentibus orbiculari-reniformibus, ferrugineo-villosis, 3 ad 3.5 mm diametro, margine ciliatis.

Ng Chi Leng, *McClure 8547*, December 20, 1921. On forested slopes, altitude about 700 meters.

This is not referable to any of the forms hitherto described from or accredited to China, and does not conform with the characters of any of the species of Indo-China. It probably belongs in the group with *Erycibe magnifica* Prain of the Malay Peninsula, although it is very different from that species.

BIGNONIACEAE

RADERMACHERA HAINANENSIS sp. nov.

Arbor glabra, ramis ramulisque griseis, rugosis; foliis pinnatis, 5-foliolatis, circiter 10 cm longis, foliolis chartaceis, oblongo-ovatis, 4 ad 6.5 cm longis, tenuiter acuminatis, utrinque minutissime puncticulatis, nervis tenuibus, utrinque 5 vel 6; inflorescentiis axillaribus, paucifloris, racemosis vel depauperato-paniculatis, quam foliis multo brevioribus; floribus flavidis 4 cm longis, calycis cylindraceis, obliquis, 1.8 cm longis, breviter 3-lobatis; corollae tubo extus glabro, deorsum (1.5 cm) angustato et intus villoso, sursum expanso, lobis late reniformi-ovatis, 10 mm latis; folliculis usque ad 40 cm longis, circiter 5 mm diametro, seminibus 12 mm longis.

Hoihow, *McClure 7648*, October 12, 1921, in dry sandy waste places at low altitudes, with the local name *hung fa*. The species is also represented by *Hongkong herbarium No. 453* collected in Hainan October 22, 1893, without locality.

A species radically different from the few representatives of the genus known from China, strongly characterized by its short, 5-foliolate, simply pinnate leaves; its greatly abbreviated, few-flowered inflorescences; and its cylindric, oblique calyx tube.

GESNERIACEAE

OREOCHARIS FLAVIDA sp. nov.

Herba perennis, acaulis, petiolis et subtus foliis densissime rufescente lanuginosis; foliis longe petiolatis, in siccitate chartaceis vel subcoriaceis, oblongo-ellipticis vel ellipticis, usque ad 16 cm longis et 7 cm latis, apice rotundatis, basi plerumque rotundatis, distincte inaequilateralibus, margine crenatis, supra hirsuta, nervis utrinque circiter 6, subobsoletis; petiolo usque ad 12 cm longo; inflorescentiis folia subaequantibus, pedunculo deorsum rufescente lanuginoso, supra subglabro; floribus subumbellatis, flavidis, circiter 2 cm longis, pedicellis tenuibus, circiter 2 cm longis; sepalis lanceolatis, acuminatis, subliberis, 5 mm longis, ciliato-pilosis; corolla subcylindrica, extus glabra, intus leviter pubescens, subaequaliter 5-lobata, lobis suborbicularis, 6.5 mm longis, leviter ciliatis; filamentis glabris, 6 mm longis, antheris horizontaliter dehiscentibus, subhippocrepiformibus; capsulis junioribus linearis, glabris, 2 cm longis.

Ng Chi Leng, *McClure 8598,* December 16, 1921. On damp rocks on forested slopes, altitude 1,400 meters.

This species conforms to the characters of *Oreocharis* in habit, appearance, and all other characters except in its somewhat horseshoe-shaped, horizontally dehiscent anthers, a character that might lead some to erect a new genus for this particular species. The dense, woolly indumentum entirely covers the lower surfaces of the leaves.

ACANTHACEAE

STROBILANTHES MACLUREI sp. nov.

Herba erecta, usque ad 0.5 m alta, plus minusve hirsuta, caulis ut videtur deorsum procumbens, glabris, 2 mm diametro, ramis tenuibus, leviter hirsutis; foliis in paribus inaequimagnis, oblongo-ovatis, acuminatis, basi acutis, crenatis, olivaceis, supra cystolithis numerosis instructis, utrinque parce hirsutis, subtus pallidioribus, nervis utrinque 4 vel 5, perspicuis, majoribus usque ad 9 cm longis et 3.5 cm latis, petiolo 1 ad 2.5 cm longo; inflorescentiis subcapitatis, terminalibus et in axillis superioribus, paucifloris, bracteis obovatis ad oblongo-obovatis, usque ad 1 cm longis, foliaceis, persistentibus, perspicue hirsutis; floribus subcaeruleis, 3 cm longis, sepalis anguste lanceolatis, acuminatis, 6 mm longis, perspicue albido-ciliatis, corollae tubo deorsum angusto, glabro, sursum ampliato, lobis brevibus; ovario glabro, apice barbato; antheris 2.5 mm longis.

Ng Chi Leng, *McClure 8578* (type), *8480,* December 21, 1921. In forested ravines, altitude 700 to 800 meters.

A species apparently most closely allied to *Strobilanthes debilis* Hemsl. from which it is distinguished by its larger crenate leaves.

RUBIACEAE

13050 **LASIANTHUS HAINANENSIS** sp. nov.

Frutex 2 ad 3 m altus, petiolis junioribus stipulisque parcissime pubescentibus exceptis glaber; ramis teretibus, laevis, circiter 3 mm diametro, internodiis 6 ad 8 cm longis; foliis oblongis, olivaceis, nitidis, chartaceis, 12 ad 16 cm longis, 3.5 ad 5 cm latis, utrinque angustatis, basi acutis, apice tenuiter acuminatis, nervis primariis utrinque circiter 15, distinctis, rectis, anastomosantibus, nervis marginalis leviter arcuatis; petiolo 10 ad 12 mm longo; stipulis oblongis, pubescentibus, acuminatis, 2.5 mm longis; fructibus axillaribus, paucis, obovoideis ad oblongo-obovoideis, sessilibus, 12 mm longis.

Ng Chi Leng, *McClure 8569*, December 3, 1921. In forested ravines, altitude about 1,400 meters.

In vegetative characters this species is very similar to *Lasianthus laevigatus* Blume from which it is at once distinguished by its solitary or fascicled sessile fruits.

COMPOSITAE

41194 **GYNURA MACLUREI** sp. nov.

Herba erecta, subglabra (partibus junioribus parce furfuraceo-pubescentibus); foliis mebranaceis, olivaceis, ovatis ad oblongo-ovatis, 7 ad 11 cm longis, 3 ad 7 cm latis, glabris, olivaceis, subtus pallidioribus, margine grosse irregulariter repando-dentatis, dentibus acutis ad apiculatis, apice acutis ad breviter acuminatis, basi truncato-rotundatis, leviter inaequilateralibus, nervis utrinque 5 vel 6, vix perspicuis; petiolo 2.5 ad 4 cm longo; stipulis semihastatis, 7 mm longis, grosse lobato-dentatis; inflorescentiis pedunculatis, terminalibus, 15 ad 17 cm longis, subpaniculatis; capitulis 1.3 ad 1.5 cm longis, multifloris, bracteolis exterioribus linearis, 2 ad 3 mm longis, interioribus 10 ad 12 mm longis, 2.5 mm latis, glabris, tenuiter acuminatis.

Ng Chi Leng, *McClure 8588* (type), *8626*, December 21, 1921. On rocks in forests and on burned-over slopes, altitude 600 to 750 meters.

Apparently well characterized by its glabrous, coarsely repand-toothed, ovate to oblong-ovate leaves, and its semihastate auriculate stipules or stipulelike appendages. The ultimate reticulations are not elongated, and contain numerous free veinlets.

THE EFFECT OF SULPHUR COMPOUNDS ON CEMENT

By J. C. WITT

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Some papers on the effect of sodium sulphide [1] and the effect of calcium sulphate [2] on cement were published by me several

TABLE 1.—*The effect of sodium sulphide on tensile strength.*

[Pounds per square inch. Each value is the average of six tests.]

NEAT.

Cement.	Sulphur, grams per liter.	1 day.	7 days.	28 days.	60 days.	120 days.	180 days.	1 year.	2 years.	3 years.	5 years.
A	(a)	353	595	685	673	688	711	638	662	576	650
A	0.097	307	586	642	606	594	696	757	610	530	528
A	0.97	300	506	548	542	635	660	666	661	571	675
A	4.80	155	300	573	560	555	615	617	557	305	527
A	9.70	190	268	391	406	477	488	523	530	528	445
B	(a)	337	617	651	649	586	621	636	591	411	457
B	0.097	411	622	611	618	605	573	573	597	501	565
B	0.97	388	579	599	581	547	601	580	567	475	537
B	4.80	340	475	567	569	564	542	543	466	454	454
B	9.70	262	460	495	526	417	457	446	475	365	397
C	(a)	330	586	679	644	686	680	695	644	558	653
C	0.097	412	577	632	666	652	681	608	613	554	675
C	0.97	407	568	605	676	563	652	602	595	565	657
C	4.80	355	461	452	503	601	625	630	622	472	520
C	9.70	341	433	410	400	532	572	597	552	540	482
D	(a)	348	633	722	677	710	695	692	617	529	546
D	0.097	335	587	726	685	716	725	698	702	670	630
D	0.97	308	554	655	642	712	738	717	642	560	648
D	4.80	214	467	630	581	631	599	717	616	593	577
D	9.70	255	553	584	584	536	595	571	563	502	446
E	(a)	388	628	731	720	706	677	706	685	559	597
E	0.097	334	638	736	676	721	686	738	649	647	638
E	0.97	340	609	645	604	666	665	636	642	564	592
E	4.80	222	456	588	589	633	630	518	576	515	550
E	9.70	268	519	539	516	506	489	517	560	506	447

[a] Water.

[1] The effect of sulphide on cement, Philip. Journ. Sci. § A 11 (1916) 273. The work suggested a later paper: The action of sodium sulphide on ferric oxide, Journ. Am. Chem. Soc. 43 (1921) 734.

[2] The effect of calcium sulphate on cement, first paper, Philip. Journ. Sci. § A 12 (1917) 133; second paper, Philip. Journ. Sci. 14 (1919) 221; Concrete 16 (1920) 32.

TABLE 1.—*The effect of sodium sulphide on tensile strength*—Continued.

1:3 STANDARD OTTAWA SAND.

Cement.	Sulphur, grams per liter.	1 day.	7 days.	28 days.	60 days.	120 days.	180 days.	1 year.	2 years.	3 years.	5 years.
A	(a)	------	238	333	360	373	399	383	382	420	381
A	0.097	------	209	292	299	356	337	333	323	390	349
A	0.97	------	174	237	320	333	346	331	365	427	376
A	4.80	------	234	240	283	259	259	268	305	376	335
A	9.70	------	124	124	258	204	246	243	256	311	297
B	(a)	------	248	308	325	319	323	284	330	382	329
B	0.097	------	233	280	399	309	305	304	320	346	315
B	0.97	------	230	258	382	305	304	309	323	371	305
B	4.80	------	174	252	290	279	277	263	292	389	311
B	9.70	------	145	218	259	266	253	257	257	324	296
C	(a)	------	282	380	428	402	450	394	425	451	417
C	0.097	------	253	357	318	401	432	452	342	361	425
C	0.97	------	248	305	290	410	393	373	402	378	384
C	4.80	------	174	155	205	355	306	389	345	379	344
C	9.70	------	168	251	157	320	339	283	333	374	340
D	(a)	------	294	409	441	402	418	399	386	420	374
D	0.097	------	239	343	383	381	411	396	394	425	393
D	0.97	------	240	329	348	392	403	364	405	450	340
D	4.80	------	162	237	288	319	320	327	323	370	349
D	9.70	------	144	226	265	299	292	316	350	315	317
E	(a)	------	331	407	414	402	438	367	342	378	375
E	0.097	------	265	319	344	361	363	325	339	448	342
E	0.97	------	374	304	351	359	360	335	335	368	389
E	4.80	------	179	279	267	319	317	287	307	364	316
E	9.70	------	157	227	249	271	260	261	265	318	268

[a] Water.

years ago. In connection with the first two papers, tensile-strength specimens were stored in water, to be broken at various periods up to five years. All of these specimens have now reached maturity and the results are given in Tables 1 and 2.

The first two papers contained such details as the chemical analyses and physical tests of the cements, the amounts of sulphide or sulphate added, and a discussion of the results obtained up to that time. Consequently this material will not be repeated here.

The five-year periods in Table 1 show some interesting results. As shown by the early tests, concentrations of sodium sulphide not exceeding 1 gram of sulphur (as sulphide) per liter do not seriously affect the tensile strength; in fact, in most cases the strength is increased. With the higher concentration, however, the strength is lowered in every case. The maximum loss is 32 per cent with the neat and 37 per cent with the mortar.

In the first paper it was pointed out that the percentage loss in tensile strength of the neat specimens, due to the highest concentration of sulphide, varied with the iron content of the cement. In general the same relationship persists after five years, as is shown in Table 3, though Cement B is an exception.

TABLE 2.—*The effect of calcium sulphate on tensile strength.*

[Pounds per square inch. Each value is the result of six tests.]

Cement.	Sulphuric anhydride (SO_3) in cement.	Neat.						1:3 standard Ottawa sand.					
		7 days.	28 days.	3 months.	6 months.	1 year.	3 years.	7 days.	28 days.	3 months.	6 months.	1 year.	3 years.
	P. ct.												
A	1.08	527	630	743	648	755	715	226	285	377	385	415	400
A	1.52	573	648	738	707	766	774	216	283	364	411	423	447
A	2.19	507	631	743	769	730	580	188	309	390	413	447	438
A	2.81	418	623	690	773	720	637	142	250	345	375	400	417
A	9.18	465	593	697	684	749	662	142	197	226	201	195	308
B	1.14	569	612	600	594	548	457	218	300	333	308	326	379
B	1.59	535	580	584	640	606	572	206	282	281	281	302	350
B	1.89	553	613	635	619	576	456	268	347	358	323	366	371
B	4.55	509	584	613	610	541	568	136	238	385	356	427	437
B	9.92	523	602	648	677	666	693	143	187	170	150	160	208
C	1.34	586	679	------	680	695	------	282	380	------	450	394	------
C	2.10	536	650	636	650	649	570	241	351	409	398	423	413
C	3.02	495	620	687	656	634	503	213	346	426	433	501	416
C	4.86	416	569	711	623	592	565	128	187	182	333	414	484
C	9.54	398	491	646	638	576	555	112	170	244	164	171	192
D	1.34	633	722	------	695	692	------	294	409	------	418	399	------
D	2.14	665	629	661	649	650	577	267	387	430	390	386	351
D	3.30	648	678	733	693	697	563	261	399	469	436	470	339
D	5.00	455	572	628	716	686	553	161	282	470	456	473	363
D	10.20	425	553	644	596	596	474	149	213	229	187	156	113
E	1.24	628	731	------	677	706	------	331	407	------	438	367	------
E	2.05	631	664	639	655	634	458	276	384	399	359	403	401
E	2.73	692	632	751	615	618	618	329	375	443	395	441	415
E	4.79	465	531	662	695	691	640	184	408	512	462	505	462
E	9.58	413	517	599	636	540	(a)	137	162	154	118	98	(a)
F	1.46	650	628	603	704	645	655	217	316	361	373	338	347
F	2.00	768	814	831	840	760	818	181	268	317	368	354	311
F	3.29	674	713	785	781	776	695	233	330	389	359	369	382
F	5.00	421	648	623	660	698	758	194	331	407	444	465	406
F	9.11	335	489	554	591	611	578	157	317	430	------	404	314

[a] These specimens were swollen, cracked, and partly disintegrated, and could not be tested.

The identification marks on five-year briquettes of the calcium sulphate series were illegible when the specimens reached maturity, so the three-year results are the last that can be considered. Table 2 shows that, for the three-year period, the presence of as much as 5 per cent of sulphuric anhydride did

not cause any serious loss in strength. In some instances there was an increase. The highest percentage of sulphuric anhydride, however, caused a decided reduction in strength. The three-year briquettes made with Cement E were cracked and partly disintegrated and could not be tested.

TABLE 3.—*Variation of percentage loss in tensile strength with the iron content.*

Cement.	Ferric oxide (Fe_2O_3).	Tensile strength of five-year neat briquettes. Gauged with—		Loss.		Corresponding loss for early period.
		Water.	Sodium sulphide solution containing 9.70 g. per liter.			
	P. ct.	*Lbs. per sq. in.*	*Lbs. per sq. in.*	*Lbs. per sq. in.*	*P. ct.*	*P. ct.*
D	1.12	546	446	100	18.31	18.56
B	1.34	457	397	60	13.13	24.07
E	1.38	597	447	150	25.13	26.12
A	1.42	659	445	214	32.47	47.29

THE USE OF TEXTILE FIBERS IN MICROSCOPIC QUALITATIVE CHEMICAL ANALYSIS

V. THE DETECTION OF GOLD BY MEANS OF STANNOUS CHLORIDE-PYROGALLOL VISCOSE-SILK FIBERS [1]

By Howard Irving Cole

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The reduction of a solution of gold chloride by a mixture of stannic and stannous chlorides leads to the formation of a red or violet color in the gold solution. This color is due to the precipitation of finely divided gold on the stannic hydroxide. It is called purple of Cassius because A. Cassius wrote a pamphlet entitled De Auro, describing its preparation, in 1685.

In 1904 Donau [2] applied this color reaction as a test for gold. He prepared silk fibers in the following manner: Raw-silk fibers were purified by treatment with 10 per cent sodium or potassium hydroxide, for from three to four hours, and then thoroughly washed. The fibers were treated with a dilute solution of stannous chloride and pyrogallol, washed several times with water, and dried between filter paper. Donau states that silk fibers thus prepared last two or three days, but if exposed longer to the air they become dark colored in the gold solution.

He made the test for gold as follows: The gold was dissolved in aqua regia, and the solution was evaporated to dryness and taken up in water. A drop of this solution was placed on a slide and a fiber, treated as described above, was dipped vertically into the drop from a tiny wax cone. The fiber was then examined under the microscope. Gold turned the fiber red or red-violet.

In continuing the study of the use of textile fibers in microscopic qualitative analysis I have endeavored to make a test fiber for gold that would remain stable indefinitely and still be sensitive to the presence of a minute amount of gold. The prep-

[1] For Parts I to IV see Journ. Ind. and Eng. Chem. 9 (1917) 969; 10 (1918) 48.

[2] Donau, J., Monatsh. 25 (1904) 545.

aration of such impregnated fibers involved a study of the kind of fiber to be employed, the concentration of the solutions to be used, the length of time of dyeing, and the temperature of the bath. The fibers tested were wool, cotton, flax, silk, and viscose silk. The fibers were impregnated with a mixture of stannous chloride and pyrogallol. In a test solution of gold, the prepared fibers gave the following colors: Wool, blue to gray; cotton, pink; flax, silk, and viscose silk, dark red to violet. Irrespective of the color produced, viscose silk is the fiber best suited for use in microscopic qualitative analysis. The following tests were therefore made on viscose silk: Fibers were dyed for one, ten, and twenty minutes in cold and in boiling solutions of stannous chloride and pyrogallol. The concentration of each of the two chemicals was varied from 1 per cent to 20 per cent. The best results were obtained in a solution of 10 per cent stannous chloride and 10 per cent pyrogallol. The effect of the addition of hydrochloric acid to the bath was tested and is shown in Table 1.

TABLE 1.—*Color of impregnated viscose-silk fibers in gold solution prepared with varying concentrations of stannous chloride, pyrogallol, and hydrochloric acid.*

Concentration of chemical.			Time of treatment on water bath.	Color of fiber in 0.05 per cent gold solution.
Hydrochloric acid, concentrated.	Stannous chloride.	Pyrogallol.		
Per cent.	*Per cent.*	*Per cent.*	*Minutes.*	
0	1	10	10	Pale red.
1	10	0.1	10	Very pale red.
1	10	1	10	Red.
1	10	10	10	Good red.
5	10	10	10	Very good red.
10	10	10	10	Weakened fiber.
0	10	10	10	Color too light.
5	10	20	10	Good red.

A bath containing over 5 per cent concentrated hydrochloric acid or 10 per cent stannous chloride tended to weaken the fiber. Immersion for more than ten minutes in 10 per cent stannous chloride solution seriously weakened the fiber.

Stannous chloride made by dissolving 10 grams of tin in 100 cubic centimeters concentrated hydrochloric acid and adding 10 per cent pyrogallol gave a fairly good fiber when the silk was allowed to remain in the solution only one minute. Two minutes

weakened the fiber so that it could not be handled without breaking.

In the experiments discussed in this paper, when stannous chloride solution is mentioned it means that a filtered solution of stannous chloride crystals dissolved in water was used.

Viscose silk boiled for ten minutes in 0.5 per cent, 1 per cent, and 10 per cent solutions of tannic acid gave a faint blue coloration in gold solution.

Fibers treated with a solution of stannous chloride and quinol (hydroquinone) gave almost no color with gold solution.

Fibers treated with stannous chloride and resorcinol gave a pink coloration with gold solution.

All the fibers prepared as above mentioned were left exposed to the air and light for six months and tested from time to time. No marked decrease in sensitivity was noted even after six months' exposure to air. It was noted, however, that the fiber after several days' exposure to air turned dark blue in concentrated gold solution, but red to purple in dilute solution. Freshly prepared fibers gave red to purple in either dilute or concentrated gold solution.

The final method of preparation of the test fibers was as follows: Ten grams of stannous chloride crystals were dissolved in 95 cubic centimeters distilled water and 5 cubic centimeters concentrated hydrochloric acid and filtered; 10 grams of pyrogallol were added to the filtrate. The viscose-silk fibers were heated in this solution for ten minutes on the water bath. The fibers were then removed and washed well with water and dried between filter paper.

The test for gold with the stannous chloride-pyrogallol fiber is best carried out as follows: Place upon an object slide a drop of the solution (neutral) to be tested. Insert into it a fiber 5 millimeters long for only part of its length. Move the preparation on the stage of the microscope until a portion of the fiber both in and out of the drop falls within the field of vision. Note the change of color if any. Let the drop evaporate to dryness spontaneously. A red to purple color denotes gold. Strong solutions of gold immediately turn freshly prepared fibers dark red, and older fibers dark blue; weaker solutions give a red or blue color in the fiber only upon evaporation of the drop to dryness. Alkali prevents the formation of the color. Mineral acids retard the formation of the color. Reducing and oxidizing agents in general interfere. Ferrous and ferric salts,

potassium ferro- and ferricyanides interfere. Chromates and bichromates tend to give a brown tone to the red color.

Silver nitrate turns the fiber yellow to brown even in the absence of gold; but, unless silver is present in excessive amounts, it does not mask the red color produced when gold is present. Platinum salts do not color the fiber. Permanganates color the fiber brown. Ammonium molybdate and phosphomolybdate turn the fiber a light blue color, readily distinguishable from the dark blue or bluish red obtained when gold is present. None of the other basic or acid radicles interfere.

In order to express numerically the sensitivity of the fibers to gold solutions the following method was adopted: Solutions of decreasing concentration of gold were used. A drop of constant size was obtained by means of a No. 29 platinum wire in the form of a loop 1 millimeter in diameter. The drop delivered by this loop contained 0.00045 cubic centimeter. Starting with a solution of gold producing a decided color change in the fiber when the test drop is evaporated to dryness, solutions of gold of decreasing concentrations were tested until a concentration was reached which failed to give a color in the fiber. The most-dilute solution, one drop of which will produce a color change in the fiber upon evaporation of the test drop, gives the degree of sensitivity. This limit may be expressed either in terms of grams per liter or as the absolute amount contained in the drop used. The most-dilute solution which gave a good color change in the fiber in a drop containing 0.00045 cubic centimeter was one containing 0.05 gram gold per liter. Therefore, the absolute amount of gold detectable by this method is 0.000,022 milligram, or 0.022 micromilligram (0.001 milligram = 1 micromilligram).

This test for gold is applicable not only in cases where the ordinary tests are used but also when the latter cannot be used; that is, in exceedingly minute amounts of material or upon subjects which must not be disfigured in the testing.

SUMMARY

1. Viscose-silk fibers dyed with stannous chloride and pyrogallol give a very sensitive microscopic method for the detection of gold.

2. The test fibers, prepared as described, are stable. No decrease in sensitivity was noted at the end of six months.

3. A drop of solution containing 0.000,022 milligram of gold gives a positive test for gold by this method.

SOME GENERALIZATIONS ON THE INFLUENCE OF SUBSTANCES ON CEMENT AND CONCRETE

SECOND PAPER

By J. C. Witt

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This paper is one of a series published as a result of research started by me at the Bureau of Science in 1915 to investigate the effect of some inorganic substances on cement and concrete.[1] The work was confined to neat and mortar specimens with the idea of later trying the effect of the most-active substances on concrete. Since sulphur compounds were frequently mentioned in the literature as destructive agents, the work was begun with these—first sulphides and then sulphates. The effect of sulphides was found to be related to the iron content of the cement, and this led to an investigation of the reaction between sodium sulphide and ferric oxide.[2] Also another problem related to the effect of inorganic salts was taken up; namely, the solubility of cement in water.[3]

The work with sulphides and sulphates led to a study of the effect of a number of other salts [4] on the setting time and tensile strength, and it is chiefly with this phase of the work that the present paper is concerned. A review of the literature revealed that while many papers had been published little definite information was available, and the subject as a whole showed little progress. No uniform method in making tests had been followed by the various investigators, and consequently there was no basis for comparing their results.

Solutions were made from eleven salts (four concentrations of each) and these solutions were used in making setting-time tests, and 1 : 3 standard Ottawa sand briquettes with four cements. The briquettes were stored in water and broken at the end of 7 days, 28 days, 180 days, 1 year, and 5 years. Each

[1] Philip. Journ. Sci. § A 11 (1916) 273; 12 (1917) 133; 14 (1919) 221; 21 (1922) 357.

[2] Journ. Am. Chem. Soc. 43 (1921) 734.

[3] Philip. Journ. Sci. § A 13 (1918) 147; Concrete 16 (1920) 13.

[4] Philip. Journ. Sci. § A 13 (1918) 29. This will be called the "first paper" in the discussion that follows.

TABLE 1.—*The effect on tensile strength.*

[Pounds per square inch. All briquettes are 1:3 standard Ottawa sand. Each value is the average of three tests.]

Salt and normality of solution.	Cement I.					Cement II.				
	7 days.	28 days.	180 days.	1 year.	5 years.	7 days.	28 days.	180 days.	1 year.	5 years.
Water	267	359	365	366	310	280	351	373	372	320
Sodium chloride:										
0.05	214	264	246	268	325	202	238	269	255	278
0.10	205	296	335	383	333	210	292	316	321	292
0.50	243	330	401	373	402	275	307	379	381	362
1.00	267	387	421	360	317	235	295	359	360	396
Zinc chloride:										
0.05	235	275	295	263	259	210	267	282	269	248
0.10	212	230	329	335	330	252	327	344	335	311
0.50	263	393	467	449	367	284	396	473	501	404
1.00	244	344	476	472	337	250	333	430	497	355
Copper chloride:										
0.05	218	294	331	265	275	183	254	270	240	248
0.10	221	326	308	333	327	203	262	372	347	338
0.50	140	370	450	467	446	153	361	418	352	331
1.00	176	319	474	465	360	244	333	407	465	326
Sodium nitrate:										
0.05	206	290	316	269	278	211	238	272	278	290
0.10	195	298	310	316	310	231	301	336	308	312
0.50	272	401	437	406	374	283	307	362	357	340
1.00	187	313	386	359	306	196	290	339	325	288
Potassium nitrate:										
0.05	209	261	283	276	296	190	255	273	266	290
0.10	215	280	364	315	350	227	326	347	348	334
0.50	197	266	361	366	352	208	293	338	348	319
1.00	217	300	337	340	310	207	289	315	304	280
Ammonium nitrate:										
0.05	221	288	290	287	320	241	268	287	259	315
0.10	249	306	348	312	339	242	288	313	333	298
0.50	233	318	415	392	382	299	365	418	346	372
1.00	301	404	439	411	369	292	390	387	399	355
Sodium sulphate:										
0.05	210	277	288	291	307	223	286	327	292	330
0.10	239	316	337	355	324	239	286	340	331	345
0.50	200	308	370	334	325	246	355	364	367	366
1.00	306	385	449	408	330	300	356	421	374	295
Zinc sulphate:										
0.05	186	266	288	256	262	258	323	313	295	333
0.10	251	318	358	344	326	231	311	359	331	376
0.50	309	430	469	495	388	283	366	475	505	380
1.00	107	385	524	462	373	263	386	406	548	368

TABLE 1.—*The effect on tensile strength*—Continued.

Salt and normality of solution.	Cement I.					Cement II.				
	7 days.	28 days.	180 days.	1 year.	5 years.	7 days.	28 days.	180 days.	1 year.	5 years.
Copper sulphate:										
0.05	252	330	351	352	347	250	345	361	320	344
0.10	205	329	358	330	326	219	295	308	321	336
0.50	108	366	495	413	406	191	340	461	448	393
1.00	56	280	413	449	358	156	362	394	363	350
Sodium bicarbonate:										
0.05	282	339	365	320	328	242	262	276	257	335
0.10	191	287	343	343	334	270	287	310	354	318
0.50	201	315	406	393	305	224	311	370	357	339
1.00	254	335	415	435	330	251	323	323	314	265
Potassium bicarbonate:										
0.05	234	331	357	314	338	226	249	288	235	374
0.10	197	270	330	320	336	243	321	353	339	347
0.50	253	369	421	364	327	243	303	394	355	375
1.00	272	343	384	366	308	234	308	346	351	398

Salt and normality of solution.	Cement III.					Cement IV.				
	7 days.	28 days.	180 days.	1 year.	5 years.	7 days.	28 days.	180 days.	1 year.	5 years.
Water	321	389	413	459	353	218	297	373	377	351
Sodium chloride:										
0.05	268	330	343	330	320	182	264	323	325	331
0.10	208	290	355	317	321	153	218	313	331	297
0.50	233	308	349	347	321	149	290	324	319	306
1.00	303	378	373	334	270	197	236	324	348	308
Zinc chloride:										
0.05	265	345	372	321	328	196	265	356	327	355
0.10	273	321	420	408	376	156	249	315	336	284
0.50	293	397	428	427	393	231	294	417	388	386
1.00	391	368	365	341	295	197	307	436	427	309
Copper chloride:										
0.05	216	390	352	322	317	170	203	365	329	348
0.10	230	319	409	399	345	141	230	321	339	344
0.50	249	348	450	470	375	99	226	367	408	290
1.00	247	408	453	425	317	185	284	395	438	325
Sodium nitrate:										
0.05	271	352	354	326	305	166	232	342	319	295
0.10	213	339	377	375	377	130	176	307	329	320
0.50	194	302	340	333	250	107	168	291	303	302
1.00	179	299	374	325	294	132	232	336	333	290

TABLE 1.—*The effect on tensile strength*—Continued.

Salt and normality of solution.	Cement III.					Cement IV.				
	7 days.	28 days.	180 days.	1 year.	5 years.	7 days.	28 days.	180 days.	1 year.	5 years.
Potassium nitrate:										
0.05	280	337	341	335	302	166	238	298	305	346
0.10	235	336	363	345	327	136	182	291	313	325
0.50	168	245	327	333	301	116	179	309	336	350
1.00	249	310	316	361	302	139	203	319	345	300
Ammonium nitrate:										
0.05	267	329	326	314	313	169	247	345	331	319
0.10	224	325	325	361	348	133	195	298	307	327
0.50	208	340	373	389	275	127	199	334	356	322
1.00	272	330	469	289	250	171	268	366	409	325
Sodium sulphate:										
0.05	302	410	487	328	265	179	228	321	325	312
0.10	266	324	337	350	347	150	220	316	345	395
0.50	184	281	370	393	307	140	205	345	333	312
1.00	282	345	430	338	290	223	323	396	389	370
Zinc suphate:										
0.05	263	385	392	311	323	201	262	341	353	359
0.10	267	334	370	384	323	183	248	349	318	312
0.50	250	365	442	441	311	226	338	417	408	400
1.00	300	413	452	412	325	272	367	419	538	375
Copper sulphate:										
0.05	277	366	373	338	315	182	281	361	355	368
0.10	252	352	351	378	339	165	235	321	403	321
0.50	168	311	393	398	340	120	284	391	418	364
1.00	258	423	526	366	230	135	316	400	461	310
Sodium bicarbonate:										
0.05	278	342	349	304	296	171	246	339	333	317
0.10	221	308	327	329	298	147	227	345	335	324
0.50	173	264	368	338	274	195	147	283	280	285
1.00	226	307	365	345	286	185	234	247	336	300
Potassium bicarbonate:										
0.05	230	363	370	316	307	207	236	351	348	365
0.10	251	332	365	367	295	165	216	339	319	336
0.50	188	256	363	352	276	98	100	274	325	374
1.00	246	309	360	369	295	152	247	277	312	260

test was made in triplicate, 2,700 briquettes in all. The first paper included the results up to 180 days. The remaining specimens have now been broken, and all the results, including those previously published, are given in Table 1. A list of the salts and the concentrations of the solutions as shown in Table 4 of the first paper is repeated here as Table 2.

TABLE 2.—*Data on solutions employed.*

Salt.	Normality.	Salt per cubic centimeter (by analysis).	Solution required for normal consistency.[a]	Parts by weight per 100 grams of cement.		
				Of salt.	Of positive radical.	Of negative radical.
		g.	*cm.*			
Sodium chloride	0.05	0.0029	22	0.0640	0.0252	0.0388
Do	0.10	0.0058	23	0.1339	0.0527	0.0812
Do	0.50	0.0291	23	0.6695	0.2634	0.4061
Do	1.00	0.0582	22	1.2810	0.5040	0.7770
Zinc chloride	0.05	0.0034	22	0.0753	0.0361	0.0892
Do	0.10	0.0068	23	0.1575	0.0756	0.0819
Do	0.50	0.0342	23	0.7874	0.3779	0.4095
Do	1.00	0.0685	22	1.5065	0.7226	0.7839
Copper chloride	0.05	0.0034	22	0.0741	0.0351	0.0390
Do	0.10	0.0067	23	0.1549	0.0732	0.0817
Do	0.50	0.0337	23	0.7745	0.3663	0.4082
Do	1.00	0.0674	22	1.4824	0.7011	0.7813
Sodium nitrate	0.05	0.0043	22	0.0937	0.0253	0.0684
Do	0.10	0.0085	23	0.1959	0.0530	0.1419
Do	0.50	0.0426	23	0.9795	0.2650	0.7145
Do	1.00	0.0852	22	1.8739	0.5069	1.3670
Potasium nitrate	0.05	0.0051	22	0.1116	0.0432	0.0684
Do	0.10	0.0102	23	0.2334	0.0904	0.1430
Do	0.50	0.0508	23	1.1670	0.4520	0.7150
Do	1.00	0.1015	22	2.2332	0.8646	1.3686
Ammonium nitrate	0.05	0.0040	22	0.0883	0.0199	0.0684
Do	0.10	0.0080	23	0.1846	0.0416	0.1430
Do	0.50	0.0401	23	0.9230	0.2079	0.7151
Do	1.00	0.0803	22	1.7659	0.3978	1.3681
Sodium sulphate	0.05	0.0036	22	0.0785	0.0254	0.0531
Do	0.10	0.0071	23	0.1643	0.0532	0.1111
Do	0.50	0.0357	23	0.8215	0.2661	0.5554
Do	1.00	0.0714	22	1.5719	0.5091	1.0628
Zinc sulphate	0.05	0.0040	22	0.0886	0.0359	0.0527
Do	0.10	0.0081	23	0.1852	0.0751	0.1101
Do	0.50	0.0403	23	0.9260	0.3753	0.5507
Do	1.00	0.0806	23	1.7721	0.7181	1.0540
Copper sulphate	0.05	0.0040	22	0.0881	0.0351	0.0530
Do	0.10	0.0080	23	0.1843	0.0734	0.1109
Do	0.50	0.0401	23	0.9215	0.3672	0.5543
Do	1.00	0.0801	22	1.7628	0.7025	1.0603
Sodium bicarbonate[b]	0.05	0.0020	22	0.0447	0.0125	0.0316
Do	0.10	0.0041	23	0.0935	0.0262	0.0661
Do	0.50	0.0203	22	0.4472	0.1259	0.3163
Do	1.00	0.0407	22	0.8947	0.2509	0.6327
Potassium bicarbonate[b]	0.05	0.0024	22	0.0538	0.0185	0.0318
Do	0.10	0.0049	23	0.1126	0.0449	0.0663
Do	0.50	0.0245	23	0.5629	0.2246	0.3319
Do	1.00	0.0489	22	1.0769	0.3706	0.6365

[a] The normal consistency values given in this column are averages for the four cements. In nearly every case the variation was only 1 or 2 per cent. In gauging Cement IV with 0.50 *N* copper sulphate and with 0.50 *N* potassium bicarbonate, however, the normal consistency was unusually high, being 26 and 28 per cent, respectively. These two values were not counted in the averages given here.

[b] The concentrations of these solutions are based on the amount of CO_3 present. They are only half the indicated concentrations with respect to alkalinity.

All four cements when gauged with water alone show a decrease in tensile strength between the 1-year and the 5-year periods. The general effect of the various salts is to lower the tensile strength—usually less than 50 pounds. In some cases, there is an increase in strength. The results are not sufficiently regular to permit any definite conclusions as to the relative effect of the various ions present. Cement III suffered the greatest loss in strength. A comparison of the chemical analysis of the four cements offers no clue as to why this should be the case. In the physical tests this cement is higher in fineness than any of the others. Up to one year its tensile strength is much higher than that of the others, but it falls off considerably between the first and the fifth years.

The results given in this paper and also those obtained by other investigators since this work was carried out indicate that in general—in the case of concrete, at least—ordinary inorganic substances are less likely to affect the strength of cement when they are used in the mixing water than when present in water to which hardened concrete is exposed. In fact, this is true of many substances, both organic and inorganic. Recently a series of concrete specimens was made, using a number of industrial waste waters.[5] These waters contained large quantities of various substances in solution, and it was expected that they would show very erratic results. However, in most cases the specimens already broken have not shown any ill effects.

At first it seems peculiar that a given water should have less effect when mixed with concrete than when brought into contact with the finished concrete because, of course, there is much more intimate contact in the former case. In the tests made in the Bureau of Science, a normal solution of sodium sulphate had little or no effect on either of the four cements used, while concrete specimens exposed to much more dilute solutions of the same salt may become completely disintegrated. The explanation for this is found in the relative quantities of the foreign substance present. The amount of a substance in solution that can be added to cement through the agency of the mixing water is relatively small. For example, when briquettes were made, using normal sodium sulphate solutions as the mixing water, the sulphuric anhydride added was only approximately 1.4 per cent of the calcium oxide present in the cement. When concrete is exposed to waters containing sulphates in the field, usually the amount of sulphuric anhydride present in relation

[5] From a paper by D. A. Abrams which has not yet been published.

to the calicium oxide is unlimited. A number of disintegrated concrete tiles recently examined contained sulphuric anhydride as high as 50 per cent of the calcium oxide present.

In the first paper it was stated that—

> The great variety of uses which modern industry is finding for concrete is continually presenting new problems for research and likewise increasing the importance of work that was completed at a time when the theoretical side was perhaps the only one under consideration. * * * This field of research is becoming more important year by year, because of the many new demands being made on the material. Sewer and drain pipe, storage tanks for various liquids, and even boats are now made of concrete. Therefore it is not suprising that the material should be called upon to resist conditions which were not known a few years ago.

These statements are even more applicable to-day than they were five years ago. Notwithstanding the retarding influence of the World War, when labor, fuel, equipment, and transportation were all difficult to obtain, more cement has been produced in the United States during the last two years than during any other two years in the history of the industry. Development of new uses for cement has kept pace with the increase in production of the material and we are approaching that time when, according to Sunderland,[6] everyone will have the privilege of studying in a fireproof concrete schoolhouse, living in a city paved and drained with concrete, traveling all over America on concrete roads, and finally being buried in a concrete coffin.

During the last few years there has been great activity in the manufacture of various substances to modify the properties and behavior of cement. There are hardeners, set accelerators, antifreeze mixtures, waterproofing compounds, and paints and coatings for decoration and protection against various substances. There are compounds for making cement more economical, for increasing the early strength, for increasing the ultimate strength, for increasing density, and for decreasing density. Without discussing the merits of these compounds, it may be readily seen that they introduce many new problems.

[6] Address by L. T. Sunderland, president of the Portland Cement Association, May 16, 1921.

NEW OR LITTLE-KNOWN TIPULIDÆ FROM THE PHILIPPINES (DIPTERA)

By CHARLES P. ALEXANDER

Of Urbana, Illinois

A small but very interesting collection of Philippine crane flies has been received from Prof. Charles Fuller Baker, of the College of Agriculture, University of the Philippines, and is discussed in this paper. Types of all unique specimens have been returned to Professor Baker and so indicated in the text. I have been permitted to retain the types of certain other species, but in all cases duplicate material of these are in Professor Baker's collection. My sincere thanks are extended to Professor Baker for the privilege of studying this important collection of Philippine Tipulidæ.

LIMNOBIINÆ

Conosia irrorata (Wiedemann).

Limnobia irrorata WIEDEMANN, Aussereur. zweifl. Ins. 1 (1828) 574.
Conosia irrorata VAN DER WULP, Tijdschr. v. Entomol. 23 (1880) 161.

LUZON, Laguna Province, Los Baños (*Baker*); a male and a female.

Epiphragma bakeri sp. nov.

General coloration light brown; legs dark brown, the knees and tarsi yellowish; wings yellow with a heavy dark brown pattern; a series of about a dozen cross veins and spurs in cell C; ventral segments yellow, the incisures narrowly dark brown.

Male.—Length, 9.5 millimeters; wing, 11.3.

Rostrum pale brown; palpi broken. Antennæ broken. Head brown, more fulvous on the vertex.

Mesonotal prescutum light reddish brown, the disk uniformly darker brown, margined anteriorly and laterally by a light gray line; scutum injured by pin, the lobes dark brown, paler laterally; scutellum injured by pin; postnotum brown basally, more pruinose on posterior half. Pleura almost uniformly brown. Halteres long and slender, pale brown, the knobs darker. Legs with the coxæ and trochanters pale brown;

femora dark brown, paler basally, the extreme tips pale yellow; tibiæ dark brown, the extreme bases pale yellow; tarsi pale brownish yellow. Wings light yellow with a very heavy, non-ocellate brown pattern, distributed as follows: Large blotches at base of cells R and M; at origin of Rs; along the cord and outer end of cell 1st M_2 and at the tips of all the longitudinal veins; a series of about ten dark brown spots in cells C and Sc; most of the remainder of the wing disk clouded with paler brown, but all of the darker brown areas surrounded by narrow, clear yellow borders; outer ends of cells Sc_1, 2d R_1, R_2, R_3, M_1, 2d M_2, M_3, Cu_1, and 1st A with conspicuous pale yellow spots; veins dark brown, paler in the yellow areas. Venation: Sc_2 at the extreme tip of Sc_1, the latter punctiform; each of the dark spots in costal cell with a spur or complete supernumerary cross vein, there being about a dozen of these beyond h; Rs long, feebly angulated at origin; R_2+_3 a little longer than the basal deflection of Cu_1; r at tip of R_1; inner ends of cells R_3 and R_5 in alignment; cell 1st M_2 large, the inner end arcuate; petiole of cell M_1 short, a little longer than R_2+_3; m a little shorter than the outer deflection of M_3; basal deflection of Cu_1 slightly sinuous, at midlength of cell 1st M_2; arcular vein completely obliterated.

Abdominal tergites with the basal half, or slightly less, of each dark brown, the remainder slightly paler, thus producing an indistinct bicolorous appearance; sternites conspicuously light yellow with the caudal margin of the segments narrowly but conspicuously dark brown; intermediate sternites with the extreme bases likewise darkened; eighth segment and hypopygium dark brown.

LUZON, Mountain Province, Benguet, Pauai (Haight's place), altitude about 2,400 meters (*Baker*). Type returned to Professor Baker.

Epiphragma bakeri is a very interesting species, distinguished from all allied forms by the series of supernumerary cross veins in the costal cell. Similar cross veins occur in the eriopterine genera *Conosia* van der Wulp and *Clydonodozus* Enderlein, but were not known in the Hexatomini. The strongest one of these cross veins has persisted in the other known species of *Epiphragma*. This handsome crane fly is dedicated to Prof. Charles Fuller Baker in appreciation of his untiring efforts to make known the remarkable insect fauna of the Philippines.

Eriocera mindanaoënsis sp. nov.

General coloration reddish, the abdomen orange with the terminal segments faintly darkened; mesonotal prescutum reddish

gray with dark red stripes; pleura pale reddish brown, faintly striped longitudinally with dark brown; legs brownish black; wings very long and narrow, strongly suffused with brown; cell M_1 present.

Male.—Length, 20 millimeters; wing, 20, its greatest width, 4.4.

Female.—Length, 22 millimeters; wing, 17.

Male.—Rostrum brown; palpi dark brown. Antennæ dark brownish black, short. Head dark brownish gray; vertex behind antennal bases light gray pruinose; immediately caudad of the antennal bases a low, black, vertical tubercle whose cephalic margin is truncated, the lateral angles prominent; immediately behind this is a second tubercle, concolorous with the remainder of the head.

Mesonotal prescutum reddish gray with three, confluent, dark red stripes; remainder of mesonotum obscure reddish brown, the posterior margin of the scutellum faintly pruinose. Pleura pale reddish brown; a distinct, longitudinal, dark brown stripe on mesepisternum; mesosternum and dorsopleural region likewise darker than the ground color of the pleura. Halteres short, dark brown, base of stem narrowly pale. Legs with the coxæ shiny dark brownish red; trochanters dark brown; remainder of legs entirely brownish black; posterior legs broken. Wings very long and narrow, more than four times as long as wide, strongly suffused with yellowish brown, brighter in the costal region; stigma lacking; veins brown. Venation: Sc_1 ending just before r, Sc_2 some distance from tip of Sc_1, the latter alone a little shorter than the basal deflection of Cu_1; Rs only a little longer than R; r–m on R_{4+5} about two and one-half times its length beyond the fork; petiole of cell M_1 a little shorter than cell; basal deflection of Cu_1 just beyond midlength of cell 1st M_2; in the right wing of the type, R_1 just before its tip bends down to R_2 in a punctiform contact; in the left wing of the same specimen there is a supernumerary cross vein in cell R_1 just beyond r.

Abdomen with tergites 1 to 4 bright orange; 5 to 7 orange with the median area faintly darkened; 8 and 9 uniformly brown; sternites similarly orange, but the terminal segments even less distinctly darkened; hypopygium small.

Female.—Similar in most respects to the male. Head darker; a clear gray line surrounding the eyes; vertical tubercles present but less developed; prescutal interspaces and a capillary median line brown, dividing the red prescutal stripes; mesosternum not

so distinctly darkened; no supernumerary cross veins in cell R_1 and petiole of cell M_1 longer than the cell; ovipositor with the valves long and slender.

MINDANAO, Bukidnon Subprovince, Tangcolan (*Baker*). The allotypic female has been returned to Professor Baker.

Eriocera mindanaoënsis is related to *E. ferruginosa* van der Wulp (Sumatra and Java). In the latter species the antennal flagellum is light colored, the femora and tibiæ are yellow with dark apices, and the abdominal tergites are margined laterally with dark brown.

Eriocera perennis polillensis subsp. nov.

Female.—Length, about 22 millimeters; wing, 16.8.

Differs from typical *Eriocera perennis* Osten Sacken, as follows: The first scapal segment of antennæ is gray pruinose like the head. Mesonotum shiny black. Legs with the femora dark brown, the tips black. Wings dark brown, the proximal end of cell 1st A pale; cell 2d A not pale at base. Petiole of cell M_1 longer than the cell. Abdominal crossbands on tergites 2, 3, and 4 only; segment 5 entirely dark.

POLILLO (*Edward H. Taylor*). Type returned to Professor Baker.

Eriocera perennis subcostata subsp. nov.

Female.—Length, about 17 millimeters; wing, 12.3.

Differs from typical *Eriocera perennis* Osten Sacken, as follows:

Rostrum and palpi black. Antennæ with the basal segment gray; second scapal and basal two flagellar segments yellow; terminal flagellar segments black. Head clear light whitish gray, the genæ becoming infuscated.

Mesonotal prescutum grayish brown with three clear-cut, confluent black stripes; remainder of thorax velvety black. Wings dark brown; base of wing broadly bright yellow, this color including about the basal third of cells C and Sc, and the cells proximad of arculus; basal fourth of cell 2d A pale; a conspicuous paler yellow crossband before the cord, extending from R into the base of cell Cu_1; cell Sc paler than the remainder of the disk, connecting the basal and discal pale areas; veins black, yellow in the pale areas. Venation: Sc_1 ending opposite midlength of the basal section of R_2; r about one and one-half times to twice its length beyond the fork of R_{2+3}; inner end of cell 1st M_2 nearly square; petiole of cell M_1 shorter than cell; basal deflection of Cu_1 at midlength of cell 1st M_2.

Abdomen velvety black, the bases of segments 2 to 6 broadly obscure orange yellow, becoming more obscure and more restricted in extent on the posterior segments; segment 7 entirely black; segments 8 and 9 orange; valves of ovipositor black.

MINDANAO, Bukidnon Subprovince, Tangcolan (*Baker*). Type returned to Professor Baker.

Eriocera chalybeicincta sp. nov.

General coloration velvety black; antennal flagellum obscure brownish yellow, darker apically; wings brownish black, the anal cells paler; cell M_1 lacking; basal deflection of Cu_1 near outer end of cell 1st M_2; abdomen velvety black, tergites 2 to 7 with shiny, metallic blue rings.

Male.—Length, 14 millimeters; wing, 13.5.

Rostrum and palpi black. Antennæ short; scapal segments black; basal three flagellar segments obscure brownish yellow, the terminal segments passing into dark brown; flagellar segments gradually decreasing in length outwardly. Head velvety black with abundant, elongate, black setæ.

Thorax entirely deep velvety black. Halteres short, dark brown. Legs with the coxæ and trochanters velvety black; femora and tibiæ dark brown, the tips black; tarsi black; legs comparatively stout. Wings brownish black with violaceous reflections; cells M and Cu adjoining vein Cu much paler in one wing of type but not in the other; anal cells grayish; a small pale streak near outer end of cell R; centers of cells 1st M_2 and Cu_1 indistinctly pale; veins black. Venation: Sc_1 ending just before r; Rs about one-third longer than R; R_2+_3 about two-thirds the deflection of R_4+_5; basal section of R_2 about equal to terminal section of R_1; basal section of M_1+_2 about two-thirds the second section; cell M_1 lacking; basal deflection of Cu_1 close to or at the outer end of cell 1st M_2; Cu_2 and outer deflection of Cu_1 subequal.

Abdomen with the first tergite black; tergite 2 velvety black with a broad, shiny, metallic blue ring before midlength; tergites 3 to 7 with a similar basal ring, more or less telescoped beneath the preceding segment; remainder of abdomen, including hypopygium, black.

MINDANAO, Kolambugan (*Baker*).

Eriocera chalybeicincta is related to *E. morosa* Osten Sacken (Celebes), from which it is distinguished by the coloration of the body and the venation, as see the position of the outer deflection of Cu_1.

Eriocera vittipennis sp. nov.

General coloration light gray; thorax with black stripes; wings whitish subhyaline, the veins broadly seamed with dark brown to produce a streaked appearance; Sc_1 longer than the basal deflection of Cu_1; r–m beyond midlength of cell 1st M_2; cell M_1 lacking; basal deflection of Cu_1 at outer end of cell 1st M_2; abdomen black, the basal and terminal segments rufous; ovipositor with the valves long and straight.

Female.—Length, about 14 millimeters; wing, 10.2.

Rostrum and palpi dark brown. Antennæ with the first scapal segment elongate, dark brown, dusted with light gray; second scapal segment and basal segment of flagellum yellowish brown, the terminal flagellar segments passing into darker brown. Head light gray, provided with abundant, long, black bristles; no distinct vertical tubercle.

Pronotum light gray. Mesonotal prescutum very light gray with three black stripes, the median stripe very broad in front, near midlength tapering rapidly to a point before the suture, conspicuously split by a pale gray vitta; lateral stripes small but conspicuous, widely separated from the intermediate stripe; scutum light gray, the centers of the lobes blackened; scutellum black, the posterior margin narrowly grayish; postnotum gray. Pleura gray, the mesosternum and mesepisternum with more blackened areas. Halteres small, brown. Legs with the coxæ dark, dusted with gray; trochanters reddish brown; femora dark brown, the bases narrowly obscure yellow, less distinct on midfemora; tibiæ and metatarsi light brown, the tips narrowly darker brown; terminal tarsal segments dark brownish black; posterior legs missing. Wings whitish subhyaline, very conspicuously streaked longitudinally with dark brown, all the veins being broadly seamed with this color, the pale centers to the cells a little narrower than the seams except in cells 1st R_1, R, and M; cells C and Sc brown; cells Cu, 1st A and 2d A more uniformly grayish brown; cells R and M narrowly interrupted by a brown wash near midlength; veins dark brown. Venation: Sc_1 ending opposite r, Sc_2 some distance from the tip of Sc_1, the latter longer than the basal deflection of Cu_1; r at fork of R_{2+3}; R_2 about two to three times R_{2+3}; R_{2+3} and the deflection of R_{4+5} subequal; basal section of M_{1+2} one-half longer than the second section; inner end of cell 1st M_2 pointed; cell M_1 lacking; basal deflection of Cu_1 almost opposite the outer end of cell 1st M_2, about equal to Cu_2.

Abdomen with the basal segment black, dusted with gray; tergites 2 and 3 bright rufous, gray pruinose basally on the sides and with a broad, median black stripe; tergites 4 to 7 black, dusted with gray; segments 8 and 9 rufous; sternites 1 to 3 and 8 and 9 rufous; sternites 4 to 7 black. Ovipositor with the valves very long and slender, rufous at base, passing into horn color at the gently upcurved tips of the tergal valves.

MINDANAO, Bukidnon Subprovince, Tangcolan (*Baker*).

Eriocera vittipennis is abundantly distinct from all described species of this large and complex genus.

TIPULINÆ

Scamboneura plumbea sp. nov.

General coloration dark plumbeous, dusted with gray; wings faintly grayish brown, cell Sc and the stigma brown; abdominal segments cross-banded with reddish orange and blue-black.

Female.—Length, 17 millimeters; wing, 15.

Frontal prolongation of head dark brownish black, narrowly obscure reddish on the dorsolateral region; nasus conspicuous, black; palpi dark brown, the elongate terminal segment paler on basal half. Antennæ black, including the scape, the tip of the second scapal segment narrowly paler. Head black, the vertex obscurely reddish behind the antennæ, the color extended as a narrow border to the eyes.

Prothorax dark plumbeous. Mesonotal prescutum and scutum dark plumbeous, only the humeral region very restrictedly obscure reddish; scutellum obscure yellow; postnotum plumbeous, the lateral sclerites more testaceous. Pleura plumbeous with a light, blue-gray bloom. Halteres dark brown, base of the stem brightened. Legs with the coxae blue-gray; trochanters yellow; femora dark brown, narrowly brighter at base; tibiæ and tarsi brownish black. Wings with a faint grayish brown tinge, a little darker beyond the cord; cell Sc and the small stigma darker brown; veins dark brownish black. Venation: Sc_1 ending opposite the base of r–m, Sc_2 at its tip; Rs short but distinct; R_2+_3 about equal to the deflection of R_4+_5, in alignment with R_4+_5; r at fork of R_2+_3; tip of R_2 atrophied; deflection of R_4+_5 directed basad as in the genus, subequal to r–m; forks of cells M_1, M_2, and M_3, deep; basal deflection of Cu_1 about two-thirds of its length beyond the fork of M. The stigma entirely fills the small cell 1st R_1.

Abdomen with the basal tergite plumbeous; segment 2 reddish, darker dorsomedially, the apical two-fifths shiny blue-

black; segments 3 and 4 with a little less than the basal half of each reddish orange, darker dorsomedially, the remainder shiny blue-black; segments 5 and 6 reddish orange, darker dorsomedially; segments 7 and 8 blue-black; segment 9 and ovipositor obscure brownish orange. Ovipositor with the tergal valves elongate, compressed, the tips rather obtusely rounded.

LUZON, Mountain Province, Benguet, Pauai (Haight's place), altitude about 2,400 meters (*Baker*).

Scamboneura plumbea is very different from the two Philippine species of the genus hitherto described. There are now five species of *Scamboneura,* all from Amboina, Java, and the Philippines. The two species from East Africa described as species of this genus by Speiser and by Riedel are not members of the genus in the sense of Osten Sacken. One, at least, belongs to the subgenus *Trichodolichopeza* Alexander, of the genus *Dolichopeza* Curtis.

Pselliophora perdecora sp. nov.

General coloration obscure orange, the abdominal segments beyond the second shiny black; legs with the femora bright yellow, the tibiæ and tarsi black; wings dark brown, the base rather broadly bright yellow.

Female.—Length, about 20 millimeters; wing, 20.

Frontal prolongation of the head orange, the nasus faintly darker; basal segments of palpi yellow with brown setæ; terminal segment yellow, the extreme tip darkened. Antennæ brownish orange throughout; first flagellar segment subequal to segments 2 and 3 combined. Head obscure orange.

Thorax entirely obscure orange, without markings. Halteres yellowish orange. Legs with the coxæ and trochanters concolorous with the pleura; femora bright yellow, the extreme apices very indistinctly darker; tibiæ and tarsi black, unmarked. Wings broad, dark brown, the base rather broadly and conspicuously bright yellow, this including about the basal fifth of cells C and Sc, the extreme bases of cells R, M, Cu, and 1st A, about the basal third of cell 2d A and all the cells proximad of arculus; an indistinct pale area immediately proximad of the stigma; a linear white streak in cell R near midlength; a similar but smaller streak near the outer end of cell M (lacking in one wing of type) and a third streak near outer end of cell 1st A; veins dark brown, yellow in the flavous basal area; obliterative breaks at the end of Rs and base of R_2+_3, basal section of M_1+_2 and the second section of M_3. Venation: Rs much longer than R_2+_3, its course subsinuous; R_2+_3 longer

than the ultimate section of R_2; cell M_1 rather broadly sessile; m–cu distinct.

Abdomen with segments 1 and 2 orange, the extreme lateral apical angle of tergite 2 darkened; remainder of abdomen shiny black, only the tips of the ovipositor deep reddish. Valves of ovipositor comparatively long and slender.

MINDANAO, Bukidnon Subprovince, Tangcolan (*Baker*).

Pselliophora perdecora belongs to the *incunctans* group of the genus, an aggregation of large, showy species that contains some of the most beautiful crane flies known. *Pselliophora incunctans* (Walker) and *P. incunctans ochrifemur* Enderlein of Celebes, *P. praefica* Bezzi and *P. tripudians* Bezzi of the Philippines, and possibly other species belong to this group.

Pselliophora praefica Bezzi.

Pselliophora praefica BEZZI, Philip. Journ. Sci. § D 12 (1917) 110.

The undescribed female of this species may be described as follows:

Length, 21 millimeters; wing, 19.

Head black, the genæ and occiput deep reddish brown. Other characters entirely as in male. Ovipositor with the valves black, only the extreme tips reddish.

MINDANAO, Kolambugan (*Baker*). Allotype. Female. The allotype has been returned to Professor Baker.

Bezzi's type male was likewise from Mindanao. In the collection of the State Natural History Museum in Vienna, Brunetti [1] found a male and a female of this species from Palawan. These he considered to represent a variety of *P. incunctans* (Walker), but in my opinion there can be no doubt but that *P. praefica* is a distinct species.

Pselliophora tripudians Bezzi.

Pselliophora tripudians BEZZI, Philip. Journ. Sci. § D 12 (1917) 111.

A female agrees very closely with Bezzi's description except that the specimen is smaller (length, 17 millimeters; wing, 16). The foreleg, lacking in Bezzi's type, is very different from the other legs and may be described as follows: Femora entirely light yellow, the tip not darkened; tibiæ yellow, the tip a little infuscated; tarsi entirely brownish black.

LUZON, Laguna Province, Los Baños (*Baker*). This specimen has been returned to Professor Baker.

[1] Rec. Indian Mus. 6 (1911) 239.

In the collection of the Paris Museum, a somewhat broken male specimen was found which is surely the male of this species. It is herewith described as allotypical.

Male.—Similar to the female, differing as follows: Basal segments of antennæ yellow, passing into brown toward the tips; flabellations of antennæ dark brown. Mesonotum entirely orange, including also the coxæ and trochanters of all the legs; the forelegs are broken but the other legs are entirely as in the female. Abdomen black, the hypopygium conspicuously and abruptly reddish orange, only the caudal margin of the ninth tergite and the pleural appendages dark.

LUZON, Manila, No. 246–1861. Allotype, male, in the collection of the Paris Museum.

Pselliophora tripudians is evidently allied to, but distinct from, *P. incunctans* (Walker) of Celebes. The thoracic pattern is paralleled in the two sexes of the two species.

Pselliophora pumila sp. nov.

General coloration black, the mesonotal prescutum yellow with three grayish brown stripes; all tibiæ ringed basally with white; wings grayish brown; cells C and Sc dark brown; a brown clouding along the cord; abdomen black, the caudal margin of tergites 2 to 4 narrowly yellow.

Male.—Length, 10 millimeters; wing, 11.

Frontal prolongation of head dark brown; palpi concolorous. Antennæ dark brown throughout; flabellations of antennæ conspicuously clothed with white hairs. Head dark brown.

Pronotal scutum dark brown; scutellum dark brown medially, the lateral portions yellow. Mesonotal prescutum yellow with three conspicuous brown stripes that are dusted with gray; median stripe very broad; lateral stripes small, confluent with the median stripe near suture; pseudosutural foveæ small, brown; scutum and postnotum black; scutellum black with conspicuous, elongate, yellow bristles and delicate transverse rows of microscopic yellow hairs. Pleura dark brown, the extreme dorsopleural region faintly yellowish. Halteres dark brownish black, the base of the stem indistinctly yellow. Legs with the coxæ and trochanters black, femora black, about the basal half of the posterior femora more testaceous; tibiæ black with a conspicuous white ring just beyond the base, this broadest and most distinct on the posterior tibiæ; tarsi black. Wings clouded with grayish brown; costal region dark brown, including cells C and Sc; paler brown clouds along the cord and along vein Cu; veins dark brown. Venation: Sc_2 ending about opposite two-

thirds Rs; R_2+_3 short, about equal to the distal section of R_2, much shorter than the basal deflection of Cu_1; cell M_1 very short-petiolate; a slight fusion of M_3 and Cu_1.

Abdomen shiny black, the caudal margins of tergites 2, 3, and 4 rather narrowly but conspicuously yellow. Hypopygium comparatively large and complex, black, the ninth segment elongate-cylindrical and tilted at an angle to the remainder of the abdomen.

LUZON, Mountain Province, Benguet, Pauai (Haight's place), altitude about 2,400 meters (*Baker*).

Pselliophora bicinctifer sp. nov.

General coloration black; antennal flagellum with only nine segments; mesonotal prescutum obscure yellow with three brownish black stripes; halteres yellow; tibiæ dark brown with a basal and a subterminal yellowish ring; wings pale grayish yellow, the cells beyond the cord dark brown; abdomen deep rufous, the tergites trilineate with black, the sternites with only the lateral margins narrowly darkened.

Female.—Length, about 17 millimeters; wing, 15.

Frontal prolongation of the head dark brownish black, clothed with conspicuous golden yellow and black bristles interspersed; palpi brown, the third segment pale at base and apex; terminal segment black beyond the base. Antennæ with the first segment brownish black, the remainder bright orange yellow; flagellum with only nine segments, the first segment shorter than the second and third combined; segments 2 to 5 narrow at base, the proximal face dilated; terminal segments flattened, disklike, greatly crowded. Head dark brownish black.

Pronotum dark brownish black. Mesonotal prescutum obscure yellow, with three conspicuous brownish black stripes, the median stripe narrowed behind but attaining the suture; scutal lobes with brownish black centers; median area in front with a triangular shiny area immediately behind the suture; scutellum brown; postnotum dark brown. Pleura dark velvety brownish black. Halteres light yellow. Legs with the coxæ velvety brownish black; trochanters brownish black, the tips fading into reddish; femora yellow, the tips broadly and conspicuously blackened; tibiæ yellow, the tips narrowly dark brown; a conspicuous dark brown annulus occupies the mid-center of each tibia, restricting the ground color to a narrow basal and a slightly broader subapical yellow ring; metatarsi yellow, the tips black; remainder of tarsi black; inner face of claws microscopically denticulate. Wings with the cells proxi-

mad of the cord light grayish yellow, the broad apex brown; stigma still darker brown; cell C darkened except for a narrow space at either end; cell Sc dark except for a narrow space at base; a conspicuous dusky cloud along vein 1st A; base of wing brighter yellow; a band along the cord (including base of cells 1st R_1, 1st M_2, M_4, and Cu_1 and the outer ends of cells R and most of M, especially along vein Cu) much clearer yellow than the remainder of the basal cells; anal cells pale; veins dark brown, yellow in the pale areas, including the entire length of vein Cu. Venation: Rs arcuated; R_2+_3 about equal to the distal section of R_2; R_2 at base perpendicular to R_2+_3; cell M_1 barely sessile; cell 1st M_2 irregularly pentagonal, none of the faces exactly parallel; in one wing of type a supernumerary cross vein in the base of cell M_4; fusion of M_3+_4 and Cu_1 punctiform.

Abdomen with basal tergite deep rufous, the caudal margin black; remaining tergites deep rufous, trilineate with black, the narrow median stripe slightly interrupted at the posterior margin of the segments; sternites deep rufous, the lateral margins narrowly darkened. Ovipositor with the tergal valves straight, yellowish horn color.

LUZON, Mountain Province, Benguet, Pauai (Haight's place), altitude about 2,400 meters (*Baker*). Type returned to Professor Baker.

Nephrotoma ortiva (Osten Sacken).

Pachyrrhina ortiva OSTEN SACKEN, Berliner Ent. Zeitsch. 26 (1882) 93.

LUZON, Laguna Province, Los Baños (*Baker*). A female that agrees closely with Osten Sacken's type female, except in the following characters:

Length, 15 millimeters; wing, 12.

Scutum yellow, each lobe completely traversed by a shiny black longitudinal stripe which leaves not only the median area yellow, as stated by Osten Sacken, but also the posterior lateral portions of each lobe; scutellum black; caudal margin of lateral sclerite of postnotum black.

Abdominal segments 2 to 6 with a broad, black, terminal band that is slightly, if at all, attenuated laterally, the band occupying about the posterior half of each segment.

INDO-MALAYISCHE RHYNCHITINEN (CURCULIONIDÆ)

I, SIEBENTER BEITRAG ZUR KENNTNISS DER CURCULIONIDEN

Von Eduard Voss

Waldsiedlung Spandau, Germany

DREI TEXTFIGUREN

Die mir durch Herrn Hofrat Prof. Dr. K. M. Heller, Dresden, freundlichst zur Bearbeitung überwiesene Ausbeute von Prof. C. F. Baker, Manila, muss als recht ergiebig bezeichnet

Fig. 1. Karte der Philippinen mit eingetragenen Sammelpunkten.

werden. Sie bildet einen wichtigen Beitrag sowohl zur Kenntniss der indomalayischen Fauna wie auch im besonderen der Subfamilie Rhynchitinæ. Die nachstehend beschriebenen Arten gehören der *Deporaus* und *Eugnamptus* Gruppe an. Namentlich die erste Gattung ist recht artenreich vertreten und bringt eine Anzahl neuer bisher nicht oder wenig bekannter Formen. Die *Eugnamptus*-Arten dagegen treten hier mehr zurück und scheinen in den rezenten Formen in Central Amerika ihr Hauptverbreitungsgebiet zu haben. Schon an dieser Stelle darf darauf hingewiessen werden, dass beide Gattungsgruppen in morphologischer Hinsicht eine auffallende Parallelentwicklung genommen haben und wahrscheinlich auf einen gemeinsamen Ursprung zurückzuführen sein werden; das Aufspaltungsgebiet dürfte in Indonesien zu suchen sein.

Genus **SCOLOCNEMUS** Kirsch

Scolocnemus pilosiusculus sp. nov. Fig. 2.

Kopf viel länger als breit; auf dem Scheitel und der Stirn kräftig runzlig, seitlich und hinten nur sehr fein und zerstreut punktiert; Stirn flach, Augen sehr stark vorgewölbt; Schläfen schwach gerundet, fast parallel und länger als der Augenlängsdurchmesser. Kopf wenig tief, rinnenförmig abgeschnürt; Hals kurz und schwach gerundet, zur Basis verbreitert. Rüssel so lang wie der Kopf, wenig gebogen; von der Seite gesehen, oben vor der Spitze bucklig erhoben. Fühler[1] kurz vor der Spitze des Rüssels eingelenkt; Fühlerfurche breit und tief und zur Spitze auf die Oberseite übertretend. Auf der Basalhälfte stumpf gekielt, im übrigen kräftig und dicht punktiert. Halsschild länger als breit; kräftig runzlig (wirbelartig) punktiert; in der Mitte mit feiner Längsfurche. Seitlich mässig stark gerundet, zum Vorderrand etwas stärker als zur Basis verschmälert, hier wie dort schmal gerandet. Schildchen länger als breit. Flügeldecken gut anderthalbmal so lang wie breit, seitlich fast parallel, hinter den Schultern etwas eingezogen und hinter dem

FIG. 2. *Scolocnemus pilosiusculus* sp. nov.

[1] An dem typischen Exemplare fehlen die Fühler bis auf den kurzen gedrungenen Schaft. Das Tier ist aber so charakteristisch, dass die Erkennung ohne weiteres möglich ist.

Schildchen schwach eingedrückt. Punktfurchen stark und tief, Punkte sehr dicht stehend, teilweise viereckig; Zwischenräume sehr schmal, kaum ausgebildet; hier und da findet ein feiner Punkt Platz. Tibien schlank, alle kräftig gebogen. Mitteltibien am stärksten gebogen; Vordertibien hinter der Mitte mit starkem, etwas einwärts gebogenen Dorn bewehrt. Ebenso sind die Vordercoxen auf der Spitze mit einem löffelartigen Höcker besetzt. Die Mittelbeine sind kürzer als die übrigen.

Färbung bräunlich rot. Das Abdomen, die Tibien, Hinterschenkel, Rüssel an der Seite (anscheinend auch die Fühler), und die Apicalhälfte der Flügeldecken sind geschwärzt. Behaarung der Decken hinten reihig, greis, schwach aufstehend; im übrigen ist das Tier nur sparsam und kurz behaart, lediglich das Abdomen ist mit etwas längeren greisen Haaren besetzt.

Länge, 4 Millimeter (s. r.).

BORNEO, Sandakan (*13938*), 1 Exemplar.

Genus **DEPORAUS** Leach

Uebersicht der Untergattungen.

a ¹. Hintertibien des Männchens abnormal lang, im letzten Drittel kräftig einwärts gebogen; Rüssel des Weibchens länger als Kopf und Halsschild zusammen; Schaftglied langgestreckt, den Vorderrand der Augen erreichend..... **Megalarodepus** subg. nov.

a ². Hintertibien von normaler Länge, Rüssel des Weibchens nicht länger als Kopf und Halsschild zusammen; Schaftglied kürzer, die Augen nicht erreichend.

b ¹. Rüsselspitze mit 2 aufstehenden scharfen Höckern besetzt oder mit vorgezogenem, der Länge nach gekieltem Lappen versehen.
Capylarodepus subg. nov.

b ². Rüsselspitze ohne scharfe Höcker, einfach.

c ¹. Rüssel vollständig flachgedrückt; von oben gesehen vorn sehr breit, hinten stark verengt; Fühler kurz vor der Rüsselbasis eingelenkt. Kopf gross, von der Seite gesehen breiter als das Halsschild.
Platyrhynchites subg. nov.

c ². Rüssel nicht der ganzen Länge nach flachgedrückt.

d ¹. Kopf mehr oder weniger kräftig ringsum abgeschnürt.

e ¹. Augen meist stark vorgewölbt, oft halbkugelig vorstehend (selten flacher gewölbt; dann sind sie auf der Stirn einander genähert und der Kopf ist tief vom Hals abgeschnürt); Schläfen in der Regel kürzer als der Augenlängsdurchmesser. Färbung rotgelb bis rotbraun, bisweilen sind die Flügeldecken mehr oder weniger geschwärzt oder das Halsschild trägt ein schwarzes Längsband.
Arodepus Heller i. l.

e ². Augen flach, wenig vorgewölbt; Schläfen so lang oder länger als die Augen; Hals sehr kurz oder ganz im Halsschild versenkt. Färbung schwarz oder blau.

f ¹. Der vorletzte Punktstreifen vereinigt sich mit dem Randstreifen in der Gegend der Hinterhüften.
Hypodeporaus subg. nov.

f ². Der vorletzte Punktstreifen läuft parallel dem Randstreifen bis zur Spitze der Decken..... **Deporaus s. s.**

d ². Kopf nicht deutlich abgeschnürt..... **Pseudodeporaus subg. nov.**

Deporaus (Megalarodepus) tibialis sp. nov.

Männchen.—Kopf länger als breit, mässig stark abgeschnürt; ziemlich fein und sehr dicht, fast runzlig punktiert. Stirn etwas eingedrückt und so breit wie der Rüssel vor der Basis. Augen ziemlich kräftig vorgewölbt; Schläfen nicht ganz so lang wie der Augenlängsdurchmesser, parallel, und kaum zur Einschnürung zugerundet; Hals halb so lang wie die Schläfen. Rüssel so lang wie der Kopf mit Hals, gebogen, oben gebuckelt; auf der Basalhälfte gekielt, seitlich undeutlich punktiert gefurcht; vor der Spitze kräftig verbreitert. Fühler in der Mitte des Rüssels eingelenkt. Schaftglied Keulenförmig, dreimal so lang wie breit; das erste Geisselglied lang oval, doppelt so lang wie breit; das zweite bis vierte Glied so lang wie das Schaftglied; das fünfte und sechste Glied etwas kürzer, und das siebente Glied wenig kürzer als die vorhergehenden beiden. Das erste und zweite Glied der Keule gleich lang, etwa doppelt so lang wie breit, das dritte Glied mit dem deutlich erkennbaren Endglied länger. Halsschild quer, zum Vorderrand stark zugerundet; mässig stark und dicht punktiert. Schildchen so lang wie breit. Flügeldecken anderthalbmal so lang wie breit; seitlich zunächst parallel, dann stärker verbreitert. Punktstreifen sehr kräftig und tief, Zwischenräume sehr schmal und fein punktiert. Hinterschenkel viel länger als die Vorder- und Mittelschenkel; die Hintertibien fast doppelt so lang wie die Mittelschienen, kräftig gebogen, während die anderen flach gebogen sind. Das hintere erste Tarsenglied ist wenigstens gleich zwei Drittel der Länge der Mitteltibien.

Weibchen.—Stirn etwas breiter als der Rüssel vor der Basis; Schläfen halb so lang wie der Augenlängsdurchmesser. Rüssel sehr lang und im ersten Drittel gebogen, länger als Kopf und Halsschild zusammen; oben glänzend und nicht deutlich sichtbar punktiert. Fühler im basalen Viertel eingelenkt; Fühlerfurche flach und nach vorn über die Einlenkungsstelle nicht hinausgeführt. Schaftglied sehr lang, die Spitze erreicht fast die Augen. Beine normal gebildet.

Färbung rotbraun; Apicalhälfte des Rüssels sowie der grössere hintere Teil der Flügeldecken schwarz. Auch die Tibien sind mit den Tarsen mehr oder weniger angedunkelt. Behaarung kurz, halbaufstehend; einige zerstreute Haare stehen län-

ger auf. Unterseite lang anliegend greis, doch nicht sonderlich dicht behaart.

Länge, 4.5 bis 5.5 Millimeter (s. r.).

BORNEO, Sandakan, 1 Pärchen.

Deporaus (Capylarodepus) galerucoides Heller.

Deporaus nigrilineatus sp. nov.

Unter den Arten mit Doppelhöcker auf der Rüsselspitze auffällig durch die mit breitem schwarzem Nahtband und schwarzen Seitenrändern gezeichneten Flügeldecken.

Kopf seicht eingeschnürt; auf dem Scheitel stärker und dichter, seitlich und hinten feiner und zerstreuter punktiert. Stirn schwach eingedrückt, breiter als der Rüssel vor der Basis. Schläfen parallel, fast so lang wie der Augenlängsdurchmesser. Rüssel so lang wie das Halsschild auf dem Rücken, schwach gebogen, zur Spitze mässig verbreitert. Fühler kurz vor der Mitte des Rüssels unter einer höckerigen Wulst eingelenkt. Schaftglied kräftig, doppelt so lang wie breit; das erste Geisselglied schwächer, cylindrisch; das zweite Glied anderthalbmal so lang wie das Schaftglied, verkehrt kegelförmig; die nächsten Glieder etwas kürzer als das zweite Glied, in der Länge jedoch kaum verschieden. Das erste und zweite Glied der Keule gleich lang, jedes so lang wie das zweite Geisselglied; das dritte Glied länger und schwächer, schlank, zugespitzt. Halsschild so lang wie breit, seitlich kräftig gerundet; vor der Basis etwas eingezogen und hier breiter gerandet; zum Vorderrand stärker verschmälert und feiner gerandet. Punktierung oben ziemlich kräftig und dicht, seitlich fein und zerstreut; glänzend. Schildchen so lang wie breit, an der Spitze tief dreieckig ausgeschnitten. Flügeldecken fast doppelt so lang wie breit; in der Mitte seitlich etwas eingezogen. In den Punktfurchen stehen im hellen Feld mässig starke Punkte um mehr als die grösse ihres Durchmessers von einander entfernt. Zwischenräume gewölbt und fein punktiert. Vorder- und Mitteltibien gerade, Hintertibien etwas länger und leicht gebogen.

Färbung der Körperunterseite bis auf die gelbbraunen Seiten schwarz; ebenso die Seiten der Mittel- und Hinterschenkel, das Schildchen, ferner der Seitenrand und die Naht der Flügeldecken breit schwarz gefärbt; Beine, Fühler, und der restliche Teil der Decken gelb; im übrigen ist das Tier rotgelb bis rötlich braun gefärbt. Behaarung der Flügeldecken kurz und wenig aufgerichtet; die Seitenteile der Brust sind lang anliegend silbergreis behaart, die Haare verdecken den Untergrund. Abdomen,

Beine, und die Unterseite des Rüssels sind lang abstehend behaart.

Länge, 7.5 Millimeter (s. r.).

BORNEO, Sandakan, 1 Tier. SUMATRA, Tandjong Poera (*R. Heintze* ges.), 1 Exemplar. Das Exemplar von Borneo ist namentlich im Halsschild etwas dunkler, stellenweise schwarz gefärbt; die Punktierung ist auf dem Halsschild in der Nähe der Mittelfurche schwach verrunzelt. Weitere grundlegende Unterschiede waren nicht festzustellen.

Deporaus rugicollis sp. nov.

Kopf nur seicht abgeschnürt, fein und zerstreut punktiert; matt. Augen weniger vorgewölbt als bei den nächsten Arten; die Entfernung zwischen Augenhinterrand und Halsschildvorderrand grösser als der Augenlängsdurchmesser. Schläfen parallel. Stirn flach und breiter als der Rüssel vor der Basis. Dieser kurz und gedrungen, kaum so lang wie der Kopf, matt. Fühler in der Mitte des Rüssels eingelenkt. Schaftglied nur wenig länger als breit; das erste Geisselglied so lang wie das Schaftglied, schwächer, fast walzenförmig; das zweite Glied annähernd so lang wie das Schaft- und das erste Geisselglied zusammen. Halsschild länger als breit, seitlich nur schwach gerundet, am Vorderrand wenig schmaler als an der Basis, hier wie dort schmal gerandet. Punktierung kräftig querrunzlig. Schildchen so lang wie breit, an der Spitze stumpf dreieckig ausgeschnitten. Flügeldecken nach hinten schwach verbreitert. Hinter dem Schildchen quer eingedrückt. Streifen tief gefurcht, runzlig; Zwischenräume sehr schmal. Vordertibien gerade; Mittel- und Hintertibien kräftiger gebogen. Hinterbeine erheblich länger als die Mittelbeine.

Färbung rotbräunlich, die Schenkelspitzen geschwärzt. Behaarung der Decken kurz, fast anliegend; Abdomen nur sehr kurz, abstehend und zerstreuter behaart.

Länge, 5.5 Millimeter.

BORNEO, Sandakan (*13942*), 1 Exemplar.

Deporaus iliganensis sp. nov.

Dem vorigen sehr ähnlich, doch ist der Kopf kräftig und dicht punktiert, die Augen sind stärker vorgewölbt; Entfernung zwischen Augenhinterrand und Halsschildvorderrand fast so gross wie der Augenlängsdurchmesser. Rüssel etwas länger als der Kopf, schwach gebogen. Fühler lang und schlank, in der Mitte des Rüssels eingelenkt; Schaftglied kräftig, doppelt so lang

wie breit; das erste Geisselglied fast cylindrisch, mindestens doppelt so lang wie breit; das zweite Glied fast so lang wie das Schaft- und erste Geisselglied zusammen; das dritte Glied wenig kürzer als das zweite Glied; das vierte bis siebente Glied wiederum etwas kürzer und untereinander fast gleich lang. Keule kräftiger, das erste und zweite Glied gleich lang und so lang wie das zweite Geisselglied; das dritte Glied der Keule viel länger. Halsschild kaum so lang wie breit, seitlich kräftig gerundet; zum Vorderrand viel stärker verschmälert als zur Basis, an ersterem breiter, an letzterer schmal gerandet. Punktierung sehr kräftig, runzlig; die Mitte der Scheibe fein längsgefurcht. Punktstreifen der Flügeldecken tief gefurcht, die Punkte mit einander verbunden, sodass die einzelnen Punkte nicht erkennbar werden. Zwischenräume feiner runzlig punktiert. Hintertibien schwach gebogen; Schenkel und Schienen innen lang zottig behaart.

Färbung rotgelb, Seitenteile der Mittelbrust stellenweise geschwärzt. Behaarung der Decken kurz und halbaufgerichtet; Brust und Seitenteile lang anliegend, der übrige Körper länger abstehend behaart, zum Teil zottig.

Länge, 6 Millimeter.

MINDANAO, Iligan (*13954*), 1 Exemplar.

Deporaus sandakanensis sp. nov.

Der vorhergehenden Art sehr ähnlich, doch stehen die Punkte in den Punktstreifen deutlich von einander entfernt, die Zwischenräume sind stärker verrunzelt, und die Behaarung ist dichter, anliegend. Von *Deporaus rugicollis* ist sie hauptsächlich durch den stärker und dichter punktierten Kopf zu trennen.

Schläfen parallel, Augen kräftig vorgewölbt; Stirn schwach eingedrückt, längsrunzlig punktiert. Rüssel des Männchens kaum so lang wie der Kopf, des Weibchens etwas länger, schwach gebogen. Männchen: Rüssel zwischen der Fühlereinlenkung etwas buckelig und längsgefurcht, zur Spitze kräftig verbreitert. Fühler in der Mitte des Rüssels eingelenkt. Schaftglied verkehrt kegelförmig, doppelt so lang wie breit; das erste Geisselglied etwas schwächer, fast cylindrisch, doppelt so lang wie breit; das zweite Glied anderthalbmal so lang wie das erste Glied; das dritte und vierte Glied ein wenig kürzer als das zweite Glied; die restlichen Glieder fast gleich lang und wenig kürzer als das dritte und vierte Glied. Weibchen: Rüssel der ganzen Länge nach oben glatt, glänzend; seitlich ist die Wulst durch eine mässig starke Punktreihe scharf abgegrenzt. Fühler im basalen

Drittel des Rüssels unter einem seitlich vorspringenden Höcker eingelenkt; Schaftglied fast dreimal so lang wie breit; das erste Geisselglied schwächer, gut doppelt so lang wie breit; das zweite und dritte Glied gleich lang und erheblich länger als das erste Glied; die nächsten Glieder etwas kürzer und untereinander gleich lang. Halsschild so lang wie breit, seitlich schwach gerundet, an der Basis nur wenig breiter als am Vorderrand. Basis und Vorderrand breit gerandet. Punktierung auf der Scheibe kräftig runzlig, seitlich sehr fein zerstreut. Flügeldecken seitlich parallel. Streifen furchenartig, doch stehen die Punkte deutlich von einander getrennt. Zwischenräume schmal und runzlig punktiert.

Färbung gelblich braun. Behaarung der Decken kurz, fast anliegend, auf dem Halsschild kurz aufstehend; auf der Brust lang anliegend, den Untergrund jedoch nicht verdeckend. Abdomen, Beine, und Unterseite des Rüssels länger abstehend behaart.

Länge, 4.5 bis 5 Millimeter.

BORNEO, Sandakan (*13943, 13952*), 1 Pärchen.

Deporaus exophthalmus Heller.

LUZON, Los Baños.

Deporaus pilifer sp. nov.

Kopf mässig stark abgeschnürt, kräftig runzlig punktiert, Augen ziemlich stark vorgewölbt. Rüssel des Männchens so lang wie das Halsschild, des Weibchens so lang wie Kopf und Halsschild zusammen, gebogen; hinten rauh punktiert, vorn glatt und glänzend. Männchen: Fühler kurz hinter der Mitte unterhalb eines seitlichen Buckels eingelenkt. Schaftglied über dreimal so lang wie breit; das erste Geisselglied oval, etwas schwächer, kaum doppelt so lang wie breit; das zweite Glied schwach verkehrt kegelförmig und so lang wie das Schaftglied; das dritte und vierte Glied gleich lang, kürzer als das zweite Glied; das fünfte Glied nur etwa halb so lang wie das zweite Glied; das sechste Glied länger als das fünfte Glied, und das siebente Glied wenig kürzer als das vorhergehende sechste. Keule mässig kräftig. Weibchen: Fühler im basalen Viertel des Rüssels eingelenkt. Schaftglied sehr lang, die Spitze fast den Vorderrand der Augen erreichend. Das erste Geisselglied kürzer als die nachfolgenden, die in der Länge wenig verschieden sind. Halsschild so lang wie breit, stark runzlig punktiert; seitlich ziemlich kräftig gerundet, zum Vorderrand mehr als zur Basis verschmälert; an der Basis schwach gerandet. Schildchen so lang wie breit, an der Spitze nicht ausgebuchtet

und hier bewimpert. Flügeldecken nicht ganz doppelt so lang wie breit, nach hinten zu wenig verbreitert, sehr stark punktiert. Zwischenräume nicht ausgebildet.

Färbung braunschwarz, Rüssel und Halsschild mehr rotbraun. Behaarung lang abstehend; auch das Abdomen abstehend, die Brust mit Seitenteilen jedoch anliegend behaart.

Länge, 4 bis 4.5 Millimeter.

SINGAPORE (*13925*), 2 Männchen und 1 Weibchen.

Durch die aufstehende Behaarung der Flügeldecken, die stärkeren Punktstreifen, und den runzlig punktierten Kopf von den nächstverwandten Arten leicht zu trennen.

Deporaus (Arodepus) angustifrons sp. nov.

Kopf länger als breit, sehr kräftig abgeschnürt, fein und nicht ganz dicht punktiert, im hinteren Teil äusserst fein quergewellt. Augen wenig vorgewölbt und die Schläfen fast so lang wie der Augenlängsdurchmesser; letztere sind kräftig gerundet zur Einschnürung verengt. Der Hals ist stark kegelförmig zum Halsschildvorderrand wieder erweitert. Augen auf der Oberseite einander genähert; Stirn daher schmaler als der Rüssel, ungefurcht. Rüssel so lang wie der Kopf, geknickt; zur Spitze schwach verbreitert, oben glänzend und feiner punktiert. Fühler hinter der Rüsselmitte eingelenkt. Schaft- und erstes Geisselglied fast gleich lang, doppelt so lang wie breit, das zweite und dritte Glied gleich lang, jedes wenig kürzer als Schaft- und erstes Geisselglied zusammen; das vierte bis siebente Glied in der Länge wenig verschieden, etwas kürzer als die beiden vorhergehenden. Keule kräftig, die zwei ersten Glieder kaum doppelt so lang wie breit. Halsschild etwa so lang wie breit, seitlich schwach gerundet und stark konisch von der Basis nach vorn verschmälert; ziemlich fein und dicht punktiert. Basalrand fein, Vorderrand breiter gerandet. Flügeldecken nach hinten schwach verschmälert. Punktstreifen kräftig, die Punkte stehen von einander etwas entfernt; Zwischenräume sehr schmal, fein punktiert.

Färbung schwarz; Vorder- und Mittelhüften, die Schenkel, und das Abdomen rötlich braun. Flügeldecken seitlich, hinten, und an der Naht schwarz, im übrigen braun. Behaarung der Decken kurz, wenig aufgerichtet. Die Seitenteile der Mittel- und Hinterbrust sind dicht und lang anliegend silbergreis, das Abdomen dünner behaart.

Länge, 3.5 Millimeter.

SINGAPORE (*13906*), 1 Exemplar.

Von allen verwandten Arten mit tief abgeschnürtem Kopf an den flachen auf der Stirn einander genäherten Augen leicht zu unterscheiden.

Deporaus penangensis sp. nov.

Kopf kräftig abgeschnürt, äusserst fein und zerstreut punktiert. Stirn so breit wie der Rüssel vor der Basis, flach und gefurcht; Augen gross und vorquellend. Rüssel des Männchens so lang, des Weibchens länger als der Kopf, gebogen, zur Spitze verbreitert; besonders auf der vorderen Hälfte glatt und glänzend, beim Männchen fein, beim Weibchen nicht deutlich punktiert. Fühler hinter der Mitte, beim Weibchen im basalen Viertel eingelenkt. Männchen: Schaftglied gut doppelt so lang wie breit; das erste Geisselglied oval, länger als breit; das zweite Glied etwas länger als das Schaftglied; das dritte Glied länger als das zweite Glied; das vierte und fünfte Glied so lang wie das zweite Glied; das sechste und siebente Glied etwas kürzer. Keule mässig stark, das erste und zweite Glied gleich lang, länger als breit; das dritte Glied doppelt so lang wie das zweite; Endglied ziemlich deutlich abgesetzt. Weibchen: Schaftglied länger, wohl dreimal so lang wie breit; das dritte Geisselglied erheblich länger als das zweite Glied; im übrigen sind die Fühler wie beim Männchen gebildet. Halsschild kaum breiter als lang, seitlich kräftig gerundet, zur Basis wenig, zum Vorderrand stark verschmälert; hier breiter, an der Basis feiner gerandet. Punktierung mässig kräftig und ziemlich dicht. Flügeldecken gut anderthalbmal so lang wie breit. Punktstreifen ziemlich stark, Zwischenräume fast so breit wie die Streifen, feiner punktiert. Tibien gerade.

Färbung bräunlich rot; Fühler, Tibien, und Tarsen, die Spitzen der Schenkel, Seitenränder, Spitze, und Naht der Flügeldecken schwarz gefärbt, die Flügeldecken im übrigen hellbraun. Behaarung der Decken kurz und etwas aufstehend. Seitenteile der Hinterbrust dicht anliegend silberweiss behaart.

Länge, 3.5 bis 4 Millimeter.

PENANG, 1 Pärchen.

Deporaus nigriceps sp. nov.

Von *Deporaus penangensis*, dem die Art sehr nahe steht, hauptsächlich in folgenden Merkmalen verschieden:

Rüssel kürzer als der Kopf, kurz vor der Basis kräftig nach unten geknickt; glänzend und unpunktiert. Das erste Glied der Fühlerkeule so lang wie das letzte Glied, Keule deutlich ab-

gesetzt. Halsschild breiter als lang. Zwischenräume der Flügeldecken nicht ganz so breit wie die Streifen.

Färbung rotgelb. Mittel- und Hinterbrust, der Kopf, die Spitzen der Klauenglieder und die Ränder sowie die schmale Naht der Decken schwarz. Behaarung der Decken greis, kurz, und teilweise erhaben. Unterseite dichter und lang anliegend silbergreis behaart.

Länge, 3.4 Millimeter (s. r.).

BORNEO, Sandakan, 1 Exemplar.

Deporaus apicalis sp. nov.

Kopf mässig stark und dicht punktiert, Augen ziemlich kräftig vorgewölbt. Schläfen viel kürzer als der halbe Augenlängsdurchmesser; parallel und dann plötzlich tief und schmal eingeschnürt; Hals parallelseitig und seitlich schwach gerundet. Rüssel etwas länger als der Kopf, schwach gebogen; seitlich stark punktiert; Spitze etwas verbreitert. Fühler wenig hinter der Rüsselmitte eingelenkt. Schaftglied dreimal so lang wie breit; das erste Geisselglied länglich oval, gut doppelt so lang wie breit; das zweite Glied etwas länger; das dritte Glied so lang wie das erste; das vierte, sechste, und siebente Glied wieder etwas kürzer als das dritte, das fünfte Glied am kürzesten, etwa anderthalbmal so lang wie breit. Keule ziemlich gestreckt; das erste und zweite Glied fast doppelt so lang wie breit, das dritte Glied länger und kräftig zugespitzt. Halsschild so lang wie breit, stark rundlich, vorn viel schmaler als an der Basis, ziemlich fein und dicht punktiert; Scheibe linienförmig längsgefurcht. Basis breit gerandet, Vorderrand sehr fein gerandet und bewimpert. Flügeldecken nach hinten schwach geradlinig verschmälert. Punktreihen mässig stark, Zwischenräume breiter als die Streifen. Vordertibien gerade, Mittel- und Hintertibien wenig gebogen.

Färbung rotgelb; Rüssel oben, Vordertibien, Spitze der Hintertibien, und die Tarsen, die Fühler, einzelne Flecken auf der Hinterbrust, die Spitzenhälfte und die Seiten der Flügeldecken schwarz. Behaarung der Decken kurz greis, fast anliegend; Unterseite silberweiss, doch weniger dicht behaart.

Länge, 4 Millimeter.

BORNEO, Sandakan, 1 Exemplar.

Deporaus taeniatus sp. nov.

Kopf länger als breit, ziemlich kräftig und dicht punktiert; Augen weniger stark gewölbt, Schläfen länger als der halbe Augenlängsdurchmesser. Rüssel viel länger als der Kopf, gebo-

gen, glänzend, seitlich fein punktiert, zwischen der Einlenkungsstelle der Fühler mit Längsgrübchen. Fühler in beiden Geschlechtern hinter der Rüsselmitte eingelenkt. Schaftglied gestreckt, fast viermal so lang wie breit; das erster Geisselglied länglich oval, gut halb so lang wie das Schaftglied; das zweite und dritte Glied etwas länger als das erste, schwächer, verkehrt kegelförmig; die nächsten Glieder allmählich an Länge abnehmend, beim Weibchen etwas gedrungener als beim Männchen; letztes Glied noch deutlich länger als breit. Keule ziemlich gedrungen, das erste und zweite Glied länger als breit, das dritte Glied am längsten. Halsschild länger als breit, stark konisch, seitlich schwach gerundet; vorn viel schmaler als an der Basis; ziemlich fein und dicht punktiert. Flügeldecken seitlich parallel; Punktstreifen mässig stark, tief eingerissen; Zwischenräume breiter als die Streifen, dicht fein punktiert.

Färbung schwarz; Fühler rotgelb oder dunkelbraun, ebenso die Beine mit Ausnahme der Vordertibien und -Tarsen, die Vorder- und Mittelhüften, das Abdomen und ein vor der Basis der Flügeldecken befindliches, nach innen verschmälertes und durch die Naht schmal unterbrochenes Querband rotgelb gefärbt. Behaarung der Decken greis, kurz, wenig erhoben. Die Seitenteile der Mittel- und Hinterbrust sowie das Schildchen anliegend silberweiss behaart.

Länge, 3 Millimeter.

BORNEO, Sandakan (*13940/41*), 1 Pärchen.

Deporaus rugiceps sp. nov.

Kopf sehr seicht eingeschnürt, sehr stark und runzlig punktiert. Stirn breiter als der Rüssel an seiner schmalsten Stelle; gefurcht. Rüssel kräftig, so lang (Männchen) oder etwas länger (Weibchen) als der Kopf, fast gerade; zur Spitze kräftig verbreitert. Fühler kurz hinter der Mitte des Rüssels eingelenkt; sehr dünn, gestreckt. Schaft- und erstes Geisselglied kräftig, anderthalbmal so lang wie breit; zweites Geisselglied fast so lang wie Schaft- und erstes Glied zusammen; die nächsten Glieder allmählich und wenig an Länge abnehmend; das siebente Glied noch mehr als doppelt so lang wie breit. Auch die Keule ist langgestreckt; das erste und dritte Glied etwa so lang wie das zweite Geisselglied, das mittlere ein wenig kürzer. Halsschild kaum länger als breit, seitlich schwach gerundet, zum Vorderrand etwas mehr als zur Basis verschmälert, an ersterem nicht deutlich, an letzterer sehr fein gerandet. Punktierung von gleicher Stärke wie die des Kopfes, runzlig. Flü-

geldecken schmal. Punktstreifen breit und tief, Zwischenräume sehr schmal.

Färbung schwarz, Abdomen dunkelbraun. Beine teilweise etwas heller braun. Flügeldecken oben dunkelbraun. Behaarung auf den Decken fast anliegend; unten dicht silberweiss, auf dem Abdomen länger abstehend behaart.

Länge, 4 Millimeter.

SINGAPORE (*13927*), 1 Pärchen.

Deporaus nigrifrons Heller.

LUZON, Los Baños.

Deporaus dimidiatus Heller.

LUZON, Mount Maquiling.

Deporaus longiceps sp. nov.

Kopf viel länger als breit und dadurch von den verwandten Arten leicht zu unterscheiden; Scheitel kräftig und dicht, hinten etwas feiner punktiert. Schläfen parallel und fast so lang wie der Augenlängsdurchmesser. Augen mässig stark vorgewölbt, Kopf mit Augen kaum breiter als das Halsschild an seinem Vorderrand. Rüssel so lang wie der Kopf, gebogen; auf der Basalhälfte scharf gekielt, zwischen der Fühlereinlenkung, die in der Mitte des Rüssels erfolgt, gefurcht. Fühler lang und schlank. Schaftglied etwas länger und kräftiger als das erste Geisselglied, letzeres länger als breit, oval; zweites Glied erheblich länger als das Schaftglied; das dritte bis sechste Glied in der Länge wenig verschieden, doch kürzer als das zweite Glied; das siebente Glied so lang wie das erste. Keule gestreckt, das erste und zweite Glied gleich lang, über doppelt so lang wie breit; das dritte Glied am längsten. Halsschild etwas länger als breit, seitlich schwach gerundet, der Vorderrand schmaler als die Basis. Punktierung mässig kräftig und dicht, doch nicht runzlig. Vorderrand ziemlich breit und tief, Basalrand fein gerandet. Flügeldecken seitlich parallel, hinter den Schultern ein wenig eingezogen. Punktstreifen sehr kräftig, sodass die Zwischenräume nicht zur Entwickelung kommen. Vorder- und Hintertibien gerade, Mitteltibien schwach gebogen.

Färbung des Rüssels und des Kopfes (mit Ausnahme der Seiten), des Halsschilds, der Basis der Decken, der Hüften und teilweise der Schenkel rotgelb bis rötlich braun; im übrigen schwarz gefärbt. Behaarung der Decken vorn sehr kurz, hinten länger anliegend. Unterseite anliegend silberweiss behaart, doch verdeckt die Behaarung nicht den Untergrund.

Länge, 4 Millimeter.

BORNEO, Sandakan (*13939*), 1 Exemplar.

Deporaus signatus sp. nov.

Kopf länger als breit, fein und entfernt stehend punktiert, sehr seicht eingeschnürt, Stirn ungefurcht. Augen mässig stark vorgewölbt; Schläfen parallel, seitlich schwach gerundet, nicht ganz so lang wie der Augenlängsdurchmesser. Rüssel wenig länger als der Kopf, schwach gebogen; oben glatt, seitlich punktiert. Fühler in der Mitte des Rüssels eingelenkt. Schaftglied und erstes Geisselglied gleichlang, gedrungen, kräftig, länger als breit; das zweite Glied länger als das erste Glied; das dritte und vierte Glied gleich lang, etwas kürzer als das zweite Glied; das fünfte bis siebente Glied in der Länge wenig verschieden und wiederum etwas kürzer als die vorhergehenden zwei. Keulenglied 1 und 2 von gleicher Länge, anderthalbmal so lang wie breit, leztes Glied etwas länger. Halsschild konisch, vorn also viel schmaler als an der Basis und seitlich mässig gerundet. Am Vorderrand nicht, Basalrand sehr fein gerandet. Punktierung fein und mässig dicht. Flügeldecken seitlich parallel, hinter den Schultern seicht eingezogen. Punktstreifen mässig kräftig, Zwischenräume flach und so breit wie die Streifen, fein und dicht punktiert. Tibien schwach gebogen, Mitteltibien kräftig und gedrungen.

Färbung braunrot. Fühlerkeule schwärzlich; Mittel- und Hintertibien und -tarsen braunschwarz. Ein breiter Mittelstreifen auf dem Halsschild ist tiefschwarz. Behaarung der Decken gelblich und fast anliegend; Unterseite sehr kurz und dünn, auf den Hinterbrust-Epimeren etwas gereiht behaart.

Länge, 3.8 Millimeter.

BORNEO, Sandakan (*13953*), 1 Exemplar.

Deporaus nigritibialis sp. nov.

Kopf mässig stark abgeschnürt; auf dem Scheitel kräftig, im übrigen fein punktiert. Schläfen parallel und so lang wie der halbe Augenlängsdurchmesser. Augen vorgewölbt, Kopf mit Augen jedoch kaum breiter als der Halsschildvorderrand. Rüssel wenig länger als der Kopf, im basalen Drittel gebogen. Fühler in der Rüsselmitte eingelenkt. Schaftglied wenig länger als das erste Geisselglied, dieses anderthalbmal so lang wie breit; das zweite Glied erheblich länger als das erste; die nachfolgenden Glieder in der Länge vom ersten Glied wenig verschieden. Keule lang und kräftig, das erste und zweite Glied derselben doppelt so lang wie breit, das dritte Glied etwas länger. Halsschild so lang wie breit, seitlich gerundet, am Vorderrand etwas mehr verschmälert als an der Basis, hier wie dort gerandet. Punktier-

ung kräftig und dicht, teilweise runzlig. Punktstreifen der Flügeldecken sehr kräftig. Zwischenräume sehr schmal und fein punktiert.

Färbung rotgelb bis rotbraun; Fühler, Tibien, und Tarsen, sowie grösstenteils die Decken mit Ausnahme der Basis schwarz. Behaarung kurz, greis, fast anliegend. Unterseite sehr dünn und sparsam behaart.

Länge, 4.2 Millimeter.

BASILAN, 1 Exemplar.

Deporaus maculiger sp. nov.

Kopf ziemlich fein und dicht punktiert, Stirn sehr seicht gefurcht. Augen gross, doch nur mässig stark gewölbt. Schläfen parallel und dann zur kräftigen Einschnürung verrundet. Russel länger als der Kopf, schwach gebogen; an der Basis gekielt, seitlich punktiert; zur Spitze schwach erweitert. Fühler hinter der Rüsselmitte eingelenkt; schlank und dünn. Schaft- und erstes Geisselglied kräftig, letzteres etwas kürzer als das erste und wenig länger als breit; das zweite und dritte Glied so lang wie das Schaftglied, gestreckt; die nächsten Glieder kürzer. Keule dünn, das lezte Glied etwas länger als die vorhergehenden. Halsschild kaum länger als breit, seitlich schwach gerundet, am Vorderrande mehr als an der Basis verschmälert; an letzterer fein gerandet, Vorderrand ungerandet. Punktierung mässig stark und sehr dicht. Flügeldecken nach hinten seitlich sehr schwach geradlinig verbreitert. Punktstreifen sehr kräftig, Zwischenräume schmaler als die Streifen, fein punktiert. Der vorletzte Streifen vereinigt sich in der Mitte mit dem Randstreifen, Zwischenraum schmal.

Färbung gelbbraun. Rüssel, Fühler, ein Fleck auf dem Kopf, und Halsschild dunkler; ebenso die Partie um das Schildchen. Flügeldecken seitlich hinten braunschwarz gefärbt. Behaarung auf den Decken wenig erhoben. Unterseite dünn und anliegend behaart.

Länge, 2.5 Millimeter.

BASILAN, 1 Stück.

Bei einem Zweiten Exemplar von Borneo, Sandakan, ist das Halsschild etwas runzlig punktiert, doch sind weitere Unterschiede kaum festzustellen. Das Tier ist etwas grösser (3.2 Millimeter) (*13937*).

Deporaus distinctus sp. nov.

Kopf länger als breit, mässig stark und nicht ganz dicht punktiert; Stirn seicht gefurcht. Augen gross, vorgewölbt,

Schläfen so lang wie der halbe Augendurchmesser, Einschnürung mässig. Rüssel wenig länger als der Kopf, seicht gebogen; Basalhälfte stumpf gekielt, seitlich ziemlich kräftig punktiert. Fühler des Männchens in der Mitte, des Weibchens hinter der Rüsselmitte eingelenkt. Schaft- und erstes Geisselglied gleich lang, etwa doppelt so lang wie breit; zweites Glied fast so lang wie die vorhergehenden Glieder zusammen; das dritte Glied um ein Drittel kürzer als das zweite Glied; das vierte Glied etwas kürzer als das dritte; das fünfte bis siebente Glied etwas länger als breit. Keule kräftig, das zweite Glied wenig kürzer als das erste und wenig länger als breit. Halsschild kaum länger als breit, seitlich schwach und gleichmässig gerundet, am Vorderrand wenig schmaler als an der Basis, an letzterer fein, an ersterer breiter wulstig gerandet. Punktierung kräftig und sehr dicht, die Mitte der Scheibe fein linienförmig gefurcht. Flügeldecken seitlich parallel. Punktstreifen kräftig, Zwischenräume schmaler als die Streifen und fein punktiert. Vorletzter abgekürzter Punktstreifen kurz und gebogen; dazwischen befinden sich noch zwei Punkte von der Stärke der Punkte in den Reihen. Tibien gerade.

Färbung rotgelb; Tibien und Tarsen braunschwarz, Fühler schwarz. Behaarung gelblich, wenig erhoben. Unterseite sehr kurz und dünn behaart.

Länge, 3.8 bis 4 Millimeter.

MINDANAO, Kolambugan und Dapitan, 1 Pärchen.

Deporaus nigricornis Heller.

LUZON, Laguna, Los Baños.

Deporaus nigricornis forma **palawana** f. nov.

Während bei der Nominatform das Halsschild runzlig punktiert ist, ist dies bei einem Tier von Palawan nicht der Fall. Die Beine sind ferner ganz schwarz und zwischen dem Rand- und Supplementstreifen befindet sich keine eingeschlossene Punktreihe. Möglicherweise handelt es sich hier auch um eine selbstständige Art; bei dem geringen Material lässt sich das allerdings schwer feststellen.

PALAWAN, Puerto Princesa (*5938*), 1 Exemplar.

Deporaus testaceus sp. nov.

Kopf etwa so lang wie breit, Stirn seicht längsgefurcht, mässig stark und ziemlich dicht punktiert. Augen gross, vorgewölbt. Rüssel wenig länger als der Kopf, schwach gebogen, zur Spitze etwas verbreitert; oben glänzend, seitlich punktiert. Fühler des Männchens kurz vor der Spitze, des Weibchens in der

Mitte des Rüssels eingelenkt. Schaftglied wenig länger als das erste Geisselglied, das zweite Glied am längsten, fast doppelt so lang wie das erste; das dritte bis fünfte Glied kürzer und wenig in der Länge untereinander verschieden; das siebente Glied des Männchens noch deutlich länger als breit, beim Weibchen so lang wie breit. Keule nicht ganz so lang wie die Geissel, mittleres Glied etwas kürzer als das erste und dritte Glied. Halsschild so lang wie breit, seitlich schwach gerundet, zur Basis wenig, zum Vorderrand kräftiger verschmälert; kräftig dicht runzlig punktiert. Flügeldecken seitlich fast parallel. Punktstreifen kräftig, Zwischenräume sehr schmal, fein punktiert.

Färbung rötlich gelb, Fühler schwach gebräunt. Behaarung gelblich, fast anliegend, die Abdominalsegmente länger abstehend behaart.

Länge 2.5 bis 2.8 Millimeter.

BORNEO, Sandakan, 1 Pärchen.

Deporaus fusculus sp. nov.

Kopf hinter den Augen kräftig und tief abgeschnürt; fein punktiert, auf dem Scheitel zerstreuter, hinten dichter. Kopf mit Augen breiter als der Vorderrand des Halsschildes. Rüssel in beiden Geschlechtern länger als der Kopf, beim Weibchen etwas länger als beim Männchen; gebogen, an der Basis stumpf gekielt, im übrigen oben glatt und nicht erkennbar punktiert, seitlich dagegen ziemlich kräftig und dicht punktiert. Fühler des Weibchens kurz hinter der Mitte, beim Männchen kurz vor dem basalen Drittel eingelenkt. Mandibeln innen tief doppelt gezähnt, aussen sehr fein, beim Männchen stumpfer doppelzähnig. Schaftglied mehr als doppelt so lang wie breit, etwas länger als das länglich ovale erste Geisselglied; das zweite und dritte Glied fast walzenförmig, dünn, und so lang wie das Schaftglied; das vierte und fünfte Glied gleich lang und etwas kürzer und kräftiger als das zweite und dritte Glied; das sechste und siebente Glied viel kräftiger und noch deutlich länger als breit. Keule kräftig und gedrungen. Halsschild etwa so lang wie breit, fein und mässig dicht punktiert; seitlich gerundet, zum Vorderrand viel stärker verschmälert als an der Basis. Flügeldecken seitlich fast parallel. Punktstreifen kräftig, Zwischenräume wenig schmaler, schwach gewölbt und fein punktiert. Vordertibien beim Männchen innen sehr fein gezähnt.

Färbung rotbraun; Fühler schwarz, ebenso die Tarsen und manchmal die Tibien und die Rüsselspitze. Behaarung gelblich,

sehr kurz und etwas aufgerichtet; Unterseite nur sehr dünn behaart.

Länge, 3 bis 3.6 Millimeter.

MINDANAO, Iligan, Dapitan, und Butuan (*4431*), 2 Männchen und 3 Weibchen.

Deporaus sulcifrons sp. nov.

Kopf etwas breiter als lang; hinten fein und weniger dicht, vorn etwas kräftiger und dichter punktiert. Stirn etwas breiter als der Rüssel an seiner schwächsten Stelle, ziemlich tief gefurcht. Einschnürung recht kräftig, Schläfen zugerundet, kürzer als der halbe Augenlängsdurchmesser. Rüssel in beiden Geschlechtern erheblich länger als der Kopf, seicht gebogen, zur Spitze mässig verbreitert; auf dem Rücken glatt, seitlich kräftig gereiht punktiert. Fühler bein Männchen in der Mitte, beim Weibchen hinter der Rüsselmitte eingelenkt. Schaftglied nicht doppelt so lang wie breit; das erste Geisselglied so lang wie das Schaftglied, länglich oval; das zweite und dritte Glied langgestreckt und gleich lang, länger als das erste Glied; das vierte bis siebente Glied ein wenig kürzer und untereinander gleich lang. Das erste Glied der Keule so lang wie das Schaft- und erste Geisselglied zusammen, das zweite Glied kürzer; das dritte Glied so lang wie das erste. Halsschild ein wenig breiter als lang, seitlich gerundet, zur Basis kaum verengt, fein gerandet; zum Vorderrand mehr verschmälert, hier eingeschnürt und gewulstet. Punktierung mässig kräftig und wenig dicht, die Mitte der Scheibe fein der Länge nach gefurcht. Flügeldecken seitlich fast parallel, nur unerheblich nach hinten verbreitert. Punktstreifen kräftig und breit, Zwischenräume sehr schmal und fein punktiert.

Färbung rotgelb; Spitzen der Tibien und Tarsen gebräunt; Fühler schwarz. Bahaarung gelblich, halbanliegend. Unterseite wenig deutlich behaart.

Länge, 3.5 bis 3.8 Millimeter.

BORNEO, Sandakan (*13955*), 1 Pärchen.

Dem *Deporaus fusculus* am nächsten stehend; während aber bei diesem das Schaftglied mehr als doppelt so lang wie breit ist, ist es bei *D. sulcifrons* nur etwa anderthalbmal so lang wie breit; das Halsschild ist kräftiger punktiert und die Färbung heller als bei *fusculus*.

Deporaus serratissimus sp. nov.

Kopf kräftig abgeschnürt, Schläfen parallel und etwa halb so lang wie der Augenlängsdurchmesser; auf dem Scheitel ziem-

lich kräftig und dicht, hinten feiner punktiert. Rüssel wenig länger als der Kopf, schwach gebogen, seitlich kräftig reihig punktiert. Fühler kurz hinter der Mitte eingelenkt. Schaft- und erstes Geisselglied etwa von gleicher Länge, gedrungen, länger als breit; das zweite Glied nicht deutlich länger als das dritte, erheblich länger als das erste Glied, die nächsten Glieder etwas kürzer werdend; letztes Glied noch deutlich länger als breit. Keule kräftig; das erste Glied wenig länger als das mittlere, das letzte am längsten. Halsschild so lang wie breit, auf der hinteren Hälfte seitlich fast parallel, dann stark gerundet nach vorn verschmälert und vor dem Vorderrande eingeschnürt. Punktierung kräftig und namentlich seitlich verrunzelt. Flügeldecken seitlich fast parallel; Punktstreifen ziemlich kräftig, Zwischenräume schmaler als die Streifen und fein punktiert. Tibien fast gerade, aussen sehr fein gezähnt.

Färbung gelblich braun, Keule dunkler. Behaarung der Decken kurz, fast anliegend; Bauch abstehend behaart.

Länge, 3 Millimeter.

BORNEO, Sandakan, 2 Exemplare.

Deporaus basilanensis sp. nov.

Kopf so lang wie breit, ziemlich fein und dicht punktiert; Stirn seicht gefurcht. Augen klein, kräftig gewölbt; Schläfen parallel, mit kleinem Radius zur verhältnissmässig wenig tiefen Einschnürung gerundet verengt; länger als der halbe Augenlängsdurchmesser. Rüssel des Männchens so lang, des Weibchens etwas länger als der Kopf, schwach gebogen, auf der Basalhälfte stumpf gekielt, seitlich kräftig punktiert. Fühler des Männchens in der Mitte, des Weibchens kurz hinter der Mitte eingelenkt. Schaft- und erstes Geisselglied gleich lang, länger als breit; das zweite und dritte Glied gleich lang und länger als das erste Glied, verkehrt kegelförmig; das vierte bis siebente Glied wiederum gleich lang und so lang wie das erste Glied. Keule kräftig, die Glieder gleich lang; die beiden ersten anderthalbmal so lang wie breit, das letzte schwächer. Halsschild so lang wie breit, seitlich schwach gerundet und am Vorderrand etwas mehr als an der Basis verschmälert, an letzterer fein, am Vorderrand wulstförmig gerandet. Punktierung mässig stark und sehr dicht. Flügeldecken seitlich parallel. Punktstreifen kräftig, Zwischenräume schmal und fein punktiert.

Färbung bräunlich rot; Fühler, Tibien, und Tarsen schwarz. Behaarung auf den Decken kaum erhoben, Unterseite sehr dünn und kurz behaart.

Länge, 3 bis 3.2 Millimeter.
BASILAN, 1 Pärchen.

Deporaus discretus sp. nov.

Kopf länger als breit, kräftig abgeschnürt, Schläfen parallel, so lang wie der halbe Augenlängsdurchmesser. Stirn und Scheitel kräftig und dicht, im übrigen fein und zerstreut punktiert. Augen ziemlich gross und vorgewölbt. Rüssel etwas länger als der Kopf, gebogen; oben glänzend, auf der Basalhälfte stumpf gekielt. Fühler in der Rüsselmitte eigelenkt, kräftig und gedrungen. Schaft- und ertes Geisselglied ungefähr gleich lang und gut anderthalbmal so lang wie breit; das zweite Glied so lang wie das erste; das dritte Glied um ein Drittel länger als das zweite Glied; das vierte bis siebente Glied so lang wie das erste. Glied 1 und 2 der Keule gleich lang, anderthalbmal so lang wie breit, letztes Glied länger. Halsschild so lang wie breit, seitlich ziemlich kräftig gerundet, zum Vorderrand etwas mehr als zur Basis verschmälert, doch nicht eingeschnürt. Basis fein gerandet. Punktierung mässig stark und nicht ganz dicht; dazwischen äusserst fein mattiert punktiert. Flügeldecken nach hinten mässig verbreitert. Punktstreifen kräftig, Zwischenräume etwa so breit wie diese und fein punktiert.

Färbung gelbbräunlich; Fühler schwarz, doch sind die Wurzeln und Spitzen der ersten Glieder gelbrot gefärbt. Behaarung kurz, halbaufgerichtet.

Länge, 2.8 Millimeter.
MINDANAO, Iligan, 1 Exemplar.

Deporaus curtirostris sp. nov.

Kopf etwa so lang wie breit, mässig kräftig und nicht dicht punktiert. Stirn mit flacher Grube versehen; Augen ziemlich gross, kräftig vorgewölbt, beim Männchen kräftiger als beim Weibchen; Kopf mit den Augen breiter als der Vorderrand des Halsschildes. Rüssel des Männchens so lang, des Weibchens länger als der Kopf, auf dem Rücken stumpf gekielt, fast gerade, zur Spitze schwach verbreitert. Mandibeln des Männchens aussen nicht, des Weibchens fein gezähnt. Fühler des Männchens in der Mitte, des Weibchens im basalen Drittel eingelenkt. Männchen: Schaftglied sehr kurz und kräftig, so lang wie breit; das erste Geisselglied wenig schwächer und wenig länger als das Schaftglied; das zweite Glied am schwächsten, verkehrt kegelförmig, so lang wie das erste Glied; die nächsten Glieder kräftig und gedrungen; das siebente Glied so lang wie

breit. Keule kräftig und so lang wie die Geissel; das erste und zweite Glied gleich lang; das dritte Glied mit dem deutlich erkennbaren Endglied doppelt so lang wie das zweite Glied, auch etwas schwächer. Weibchen: Fühler etwas schlanker, letztes Geisselglied noch deutlich länger als breit; letztes Glied der Keule nur anderthalbmal so lang wie das zweite. Halsschild kaum breiter als lang, seitlich mässig gerundet, zum Vorderrand stärker als zur Basis verschmälert. Punktierung mässig stark, dicht; Scheibe mit feiner Längsfurche. Punkte der Streifen auf den Flügeldecken kräftig und dicht, Zwischenräume schmal und gewölbt, fein punktiert.

Färbung rotbraun; Fühler, Tibien, und Tarsen schwarz. Behaarung gelblich, dünn; auf den Decken und auf der Unterseite wenig erhoben, auf dem Halsschild sehr kurz aufgerichtet.

Länge, 2.8 bis 3.6 Millimeter.

BORNEO, Sandakan (*13946*), 2 Männchen und 4 Weibchen.

Deporaus affinis sp. nov.

Kopf kräftig abgeschnürt, Schläfen fast so lang wie der halbe Augenlängsdurchmesser. Punktierung ziemlich kräftig und dicht, Stirn nur flach gefurcht. Augen gross und vorgewölbt. Rüssel kurz und kräftig, kürzer als der Kopf, geknickt. Fühler kurz hinter der Rüsselmitte eingelenkt. Schaftglied länger als breit; das erste Geisselglied wenig schwächer und so lang wie das Schaftglied; das zweite Glied am längsten, anderthalbmal so lang wie das erste; das vierte Glied deutlich etwas länger als das dritte Glied und die nächsten Glieder in der Länge wenig verschieden. Keule mässig stark, das erste Glied anderthalbmal so lang wie breit, deutlich länger als das zweite und so lang wie das dritte Glied, an welchem ein Endglied deutlich sichtbar ist. Halsschild etwas länger als breit; die basale Hälfte seitlich parallel, dann nach vorn gerundet verengt und vor dem Vorderrand breiter gerandet; Basalrand schmal gerandet. Punktierung fein und dicht. Flügeldecken seitlich parallel. Punktstreifen ziemlich kräftig, Zwischenräume kaum schmaler als die Streifen. Vorletzter abgekürzter Streifen, schwach gebogen, vereinigt sich erst hinter der Mitte der Decken mit dem Randstreifen.

Färbung gelbbraun, Unterseite etwas heller als die Oberseite. Behaarung kurz und schwach erhoben, Unterseite sehr dünn behaart.

Länge, 3 Millimeter.

BORNEO, Sandakan, 1 Exemplar.

Deporaus monticola sp. nov.

Kopf länger als breit, sehr fein und zerstreut punktiert; Stirn flach, kräftiger und dichter punktiert, breiter als der Rüssel vor der Basis in der Nähe der Fühlereinlenkung. Augen mässig vorgewölbt, Kopf mit Augen breiter als das Halsschild; Schläfen länger als die Augen, zunächst parallel, dann konisch zugerundet. Einschnürung kräftig, Hals schmal und kaum zur Basis verbreitert. Rüssel kürzer als der Kopf, geknickt; von der Fühlereinlenkung, seitlich gesehen, stark verschmälert; von oben gesehen von der Basis zur Einlenkungsstelle konisch verengt, dann zur Spitze stark verbreitert, hier doppelt so breit wie an der dünnsten Stelle. Fühler etwas hinter der Mitte des Rüssels eingelenkt. Schaft- und erstes Geisselglied länglich oval, letzteres etwas kürzer, das Schaftglied fast doppelt so lang wie breit; das zweite Glied langgestreckt, dünn, länger als das Schaftglied; das dritte Glied etwas kürzer als das zweite, dagegen wenig länger als die nachfolgenden Glieder; das siebente Glied ist noch gut doppelt so lang wie breit. Keule ziemlich kräftig, gestreckt; das erste und zweite Glied jedes so lang wie das Schaft- und das erste Geisselglied zusammen; das dritte Glied länger. Halsschild länger als breit und nur so breit wie der Kopf; kräftig und sehr dicht punktiert; Seiten fast parallel, am Vorderrand kräftig eingeschnürt, Basis fein gerandet. Flügeldecken länger als breit, nach hinten etwas verbreitert. Punktstreifen kräftig, Zwischenräume schmaler als die Streifen, feiner punktiert.

Färbung gelblich braun, Unterseite und Beine rotgelb; Keule geschwärzt. Behaarung greis, halb aufstehend.

Länge, 2.5 Millimeter.

LUZON, Mount Banahao, 1 Exemplar.

Deporaus impressipennis sp. nov.

Kopf hinter den Augen nur sehr seicht eingeschnürt; fein und dicht punktiert. Augen gross, halbrund vorquellend. Rüssel kräftig, kürzer als der Kopf; von der Seite gesehen gerade, oben mit einem Buckel, an dem die Fühler eingelenkt sind; zur Spitze mässig verbreitert, auf der Basalhälfte doppelt gefurcht. Fühler in der Mitte des Rüssels eingelenkt. Schaftglied nur anderthalbmal so lang wie breit; das erste und Zweite Geisselglied so lang wie das Schaftglied, das erste Glied länglich oval, das zweite Glied verkehrt kegelförmig; das dritte bis siebente Glied in der Länge wenig verschieden, doppelt so lang wie breit. Keule langgestreckt, letztes Glied etwas länger als das erste und

zweite Glied. Halsschild seitlich kaum gerundet, konisch, zum Vorderrand viel stärker verengt als zur Basis; vor dem Vorderrand ringsum eingeschnürt, der Rand wulstig aufgeworfen. Punktierung fein und zerstreut. Schildchen viereckig, so lang wie breit; hinten tief dreieckig bis dicht zur Basis ausgeschnitten. Flügeldecken etwas länger als breit, seitlich parallel, viel breiter als das Halsschild; Punktstreifen kräftig und tief, Zwischenräume sehr schmal, dachförmig, auf den schrägen Seiten fein punktiert.

Färbung rotgelb, Unterseite dunkler; Flügeldecken bräunlich rot. Behaarung der Unterseite sehr dünn und anliegend, der Flügeldecken etwas dichter.

Länge, 3.5 Millimeter.

BORNEO, Sandakan (*13944*), 2 Tiere.

Deporaus (Platyrhynchites) basalis sp. nov. Fig. 3.

Kopf etwas länger als breit, kräftig abgeschnürt, äusserst fein und zerstreut punktiert, breiter als das Halsschild; Augen mässig stark vorgewölbt. Rüssel nicht ganz so lang wie der Kopf, an der Basis so breit wie die Stirn, vorn stark verbreitert, fast so breit wie lang. Von der Seite gesehen sehr schmal, dadurch flach gedrückt erscheinend; schräg abwärts gebogen, oben nicht skulptiert. Fühler in nächster Nähe der Rüsselbasis eingelenkt. Schaftglied schwach keulenförmig, fast doppelt so lang wie breit; das erste Geisselglied länger als breit; das zweite Glied schwächer, wohl dreimal so lang wie breit; das dritte Glied etwas kürzer; das vierte bis siebente Glied in der Länge wenig verschieden, aber noch deutlich länger als breit. Keule mässig stark, gedrungen. Halsschild wenig länger als breit, seitlich nur schwach gerundet; ziemlich kräftig runzlig punktiert, auf der Scheibe seicht längsgefurcht. Basis fein gerandet. Flügeldecken nach hinten gleichmässig schwach verbreitert. Punktstreifen kräftig, Zwischenräume schmal. Tibien schlank, fast gerade, aussen fein gesägt. Erstes und zweites durchgehendes Abdominalsegment vollständig verschmolzen; nur seitlich bildet ein feines Grübchen den rudimentären Teil einer Trennungsnaht.

FIG. 3. *Deporaus (Platyrhynchites) basalis* sp. nov.

Färbung gelbbraun; Hinterbrust und Tarsenspitzen dunkelbraun. Behaarung überall sehr fein und dünn.

Länge, 2.4 Millimeter.
LUZON, Mount Maquiling (*5989*), 1 einziges Exemplar.

Deporaus (Hypodeporaus) conicirostris sp. nov.

Kopf länger als breit, kräftig abgeschnürt, fein und sehr dicht punktiert; Augen wenig vorgewölbt, Schläfen so lang wie der Augenlängsdurchmesser. Rüssel kaum so lang wie der Kopf, nur sehr schwach gebogen. Vor der Basis ist er seitlich eingeschnürt. Fühler beim Männchen in der Mitte, beim Weibchen kurz hinter der Mitte des Rüssels eingelenkt. Schaft- und erstes Geisselglied gedrungen, wenig länger als breit; das zweite Glied am längsten und schwächsten, länger als das erste Glied; die nächsten Glieder werden zur Spitze hin allmählich kürzer, das siebente Glied ist nur so lang wie breit. Keule gedrungen. Halsschild länger als breit, kräftig dicht und runzlig punktiert; seitlich gerundet, zum Vorderrand stark verschmälert, an der Basis fein gerandet. Flügeldecken länger als breit, nach hinten verbreitert. Punkte der Streifen kräftig, Zwischenräume schmal und fein punktiert.

Färbung schwarz, Mandibeln rötlich. Behaarung auf den Decken kurz, greis, halbaufstehend; Unterseite etwas länger anliegend, doch nicht dicht behaart.

Länge, 2 Millimeter.
LUZON, Mount Maquiling und Los Baños, 1 Pärchen.

Deporaus subrugaticollis sp. nov.

Dem *Deporaus conicirostris* sehr ähnlich. Während aber bei diesem die Punktstreifen der Flügeldecken breiter als die Zwischenräume und letztere sehr fein punktiert sind, sind sie bei der vorliegenden Art gleich breit; die Zwischenräume sind dicht und etwas stärker punktiert. Das zweite Glied der Fühlerkeule ist länger als breit; der Kopf kräftiger und sehr dicht punktiert; Rüssel etwas länger als der Kopf; Halsschild so lang wie breit.

Färbung schwarz. Behaarung wie bei dem vorigen.

Länge, 2.5 Millimeter.
BASILAN und BORNEO, Sandakan (*13936*), 2 Exemplare.

Deporaus (Pseudodeporaus) pullatus sp. nov.

Kopf länger als breit, mässig kräftig und dicht punktiert; wenig deutlich abgesetzt. Augen flach gewölbt, wenig aus der Kopfwölbung vortretend; Schläfen kaum kürzer als der Augenlängsdurchmesser, parallel. Augen auf der Stirn einander genähert, sodass die Entfernung zwischen ihnen nur halb so breit

ist als der Rüssel vor der Basis. Rüssel kaum länger als der Kopf, schwach und gleichmässig gebogen. Fühler in der Mitte des Rüssels eingelenkt. Schaft- und erstes Geisselglied gleich lang, länger als breit; zweites Glied schwächer, verkehrt kegelförmig, aber von gleicher Länge mit den vorhergehenden. Die nächsten Glieder etwas kürzer, das letzte noch deutlich länger als breit. Keule ziemlich kräftig. Halsschild wenig länger als breit, seitlich nur schwach gerundet; Vorderrand nur wenig schmaler als die Basis, kräftig quergerunzelt. Flügeldecken länger als breit, seitlich parallel. Punktfurchen ziemlich kräftig; Zwischenräume schmaler als die Streifen und fein, dicht punktiert.

Färbung bläulich schwarz. Behaarung überall fein greis, anliegend und wenig dicht.

Länge, 3 Millimeter.

PENANG, 1 Exemplar.

Deporaus periscelis sp. nov.

Kopf länger als breit, mässig kräftig und dicht punktiert, nur undeutlich abgesetzt. Augen gross und kräftiger vorgewölbt als bei *Deporaus pullatus;* Schläfen mehr als halb so lang wie der Augenlängsdurchmesser. Stirn gut halb so breit als der Rüssel vor der Basis. Dieser länger als der Kopf, schwach gebogen, kurz vor der Spitze kräftiger verbreitert. Fühler vor der Rüsselmitte eingelenkt; beim Männchen weiter zur Spitze als beim Weibchen; Schaft- und erstes Geisselglied gleich lang und gleich kräftig, länger als breit; zweites Glied langgestreckt, fast so lang wie das Schaft- und das erste Geisselglied zusammen; das dritte Glied kürzer; das vierte und fünfte Glied gleich lang und wenig kürzer als das dritte Glied; das sechste und siebente Glied gleich lang und wieder etwas kürzer als das vierte und fünfte Glied. Halsschild wenig länger, mässig stark quergerunzelt; seitlich schwach gerundet, beim Männchen zum Vorderrand etwas mehr als zur Basis verschmälert; Basis fein, Vorderrand breiter gerandet. Flügeldecken länger als breit, seitlich parallel; Punktstreifen mässig kräftig; Zwischenräume breit, sehr dicht und fein punktiert.

Färbung pechbraun bis blau; Basalhälfte der Schenkel durchscheinend gelb bis braun. Abdomen rötlich braun (Nominatform) oder schwarz wie der übrige Körper (f. *nigriventris* n.). Behaarung der Unterseite dichter weiss, Flügeldecken gelblich oder greis behaart.

Länge, 3 bis 3.5 Millimeter.

Die Nominatform, 4 Exemplare, von LUZON, Los Baños: Mount Limay. MINDANAO, Dapitan (*7342*). Die Variation von BORNEO, Sandakan (*13935*), 1 Exemplar.

Genus **DEPASOPHILUS** novum

Kopf halsartig abgeschnürt; Augen gewölbt, aus der Kopfwölbung vortretend. Rüssel gedrungen, schwach gebogen. Fühler ungeknickt, 11-gliedrig, Keule gestreckt. Flügeldecken länger als breit, seitlich parallel, hinten einzeln abgerundet, reihig punktiert. Pygidium von den Decken vollständig unbedeckt, das letzte Dorsalsegment jedoch bedeckt bis auf ein zwischen den inneren Abrundungsradien der Flügeldecken liegendes Dreieck. Vorderhüften hart am Vorderrand des Prosternums stehend. Alle Tibien gebogen, aussen fein reihig mit Sägezähnen besetzt; ebenso aussen die Schenkel auf der Spitzenhälfte fein reihig gehöckert. Das erste Tarsenglied länger als das zweite, das dritte Glied gelappt, Klauen gespalten. Erstes und zweites durchgehendes Abdominalsegment verschmolzen. Abgekürzter Nahtstreifen auf den Flügeldecken fehlt, vorletzter Punkstreifen vereinigt sich mit dem Randstreifen in der Gegend der Hinterhüften.

Hierher einstweilen die folgende Art:

Depasophilus bakeri sp. nov.

Kopf ziemlich kräftig abgeschnürt, auf dem Scheitel mit einigen kräftigen Punkten besetzt, im übrigen jedoch fein und zerstreut punktiert. Stirn nur flach eingedrückt und so breit wie der Rüssel vor der Basis. Augen des Männchens stärker vorgewölbt und die Schläfen fast so lang wie der Augenlängsdurchmesser; beim Weibchen stehen die Augen etwas weniger vor und die Schläfen sind kürzer. Rüssel des Männchens so lang, des Weibchens länger als der Kopf, nur schwach gebogen; oben glänzend und unpunktiert, seitlich beiderseits mit einer Punktfurche versehen; zur Spitze ist der Rüssel nur schwach verbreitert. Fühler des Männchens in der Mitte, des Weibchens hinter der Mitte eingelenkt. Schaft- und erstes Geisselglied wenig länger als breit; das zweite und dritte Glied gleich lang, gestreckt, etwas länger als das erste Glied; das vierte und fünfte Glied etwas kürzer; das sechste und siebente Glied noch länger als breit. Halsschild kaum länger als breit, fein und dicht punktiert, seitlich schwach gerundet, zum Vorderrand stark verschmälert; hier und an der Basis nicht erkennbar gerandet. Flügeldecken seit-

lich parallel; Punkte der Streifen vorn kräftiger als hinten; Zwischenräume so breit wie die Streifen, fein und dicht punktiert. Alle Tibien gleichmässig gebogen (die Hintertibien namentlich beim Weibchen jedoch schwächer); Schenkel und Schienen aussen sehr fein gesägt.

Färbung rotbräunlich; Fühler an der Spitze geschwärzt. Behaarung nur dünn, gelblich, anliegend.

Länge, 2.5 bis 3 Millimeter.

BORNEO, Sandakan, eine Anzahl Exemplare.

Ein Tier vom gleichen Fundort mit schwarzen Fühlern, Tibien, und Tarsen, mit seichter abgesetztem Kopf, und etwas längerer und dichterer Behaarung möge als *nigritibialis* subsp. nov. bezeichnet sein.

Genus **EUGNAMPTUS** Schönherr

Eugnamptus longicollis sp. nov.

Kopf mit den grossen vorquellenden Augen breiter als das Halsschild, Schläfen kurz und zur Abschnürung zugerundet, Hals lang; Punktierung mässig stark und dicht. Rüssel kürzer als der Kopf, gebogen, zur Spitze verbreitert; der Länge nach glänzend gekielt, seitlich rauh punktiert. Fühler hinter der Mitte des Rüssels eingelenkt. Schaftglied gut dreimal so lang wie breit, keulenförmig; das erste Geisselglied länglich oval, anderthalbmal so lang wie breit; das zweite und dritte Glied etwas kürzer als das Schaftglied; das vierte und fünfte Glied kürzer, nur etwa doppelt so lang wie breit; das sechste und siebente Glied wieder länger, doch etwas kürzer als das zweite und dritte Glied. Keule ziemlich kräftig, das zweite Glied etwas kürzer als das erste Glied; das dritte Glied fast doppelt so lang wie das zweite Glied. Halsschild länger als breit, seitlich leicht gerundet, vor dem Vorderrand plötzlich abgeschnürt und hier ein Stück parallel verlaufend; vor der Basis leicht eingeschnürt und dann etwas erweitert. Punktierung sehr kräftig und runzlig. Flügeldecken nach hinten gleichmässig schwach verbreitert. Punkte der Streifen kräftig und dicht; Spatien kaum so breit wie diese und gewölbt, weit entfernt stehend fein punktiert.

Färbung bräunlich rot; Fühler schwarz, ebenso die Tibien und die Spitze der Decken. Unterseite pechbraun, Hüften und Tarsen rotgelb. Behaarung gelblich, doppelt; überall sehr lang aufstehend und kürzer halbaufgerichtet.

Länge, 4 Millimeter.

BORNEO, Sandakan, 1 Exemplar.

Eugnamptus flavicornis sp. nov.

Kopf mit den kräftig vorgewölbten Augen ein wenig breiter als das Halsschild, doch sind die Augen nicht ganz so gross wie bei *longicollis;* Punktierung sehr fein und zerstreut. Rüssel etwas kürzer als der Kopf, schwach gebogen, auf dem Rücken stumpf gekielt, seitlich punktiert; zur Spitze verbreitert und vorn stark verrunzelt. Fühler hinter der Mitte des Rüssels eingelenkt, lang und dünn. Schaftglied verkehrt kegelförmig, gut viermal so lang wie breit; das erste Geisselglied länglich oval, kaum halb so lang wie das Schaftglied; Glied 2 bis 7 sehr dünn, fast walzenförmig, in der Länge wenig verschieden und etwas kürzer als das Schaftglied. Keule wenig kräftig, das letzte Glied nur unerheblich länger als das erste und zweite Glied. Beim Männchen sind die Fühler etwas gedrungener und die Keule kräftiger. Halsschild kaum länger als breit, zum Vorderrand etwas kräftiger als zur Basis abgeschnürt; sehr stark und dicht runzlig punktiert, seitlich schwach gerundet. Flügeldecken seitlich fast parallel. Punkte der Reihen kräftig und dicht, Zwischenräume schmal und gewölbt, fein punktiert. Hintertibien an der Spitze mit einem Dorn.

Färbung rötlich gelb. Spitzen der Decken und bei einem Exemplar auch die Seiten geschwärzt. Behaarung gelblich, doppelt; lang abstehend und kürzer halb aufgerichtet.

Länge, 4.5 Millimeter.

BORNEO, Sandakan, 1 Pärchen.

Subgenus **Eugnamptobius** novum

Während bei sämtlichen echten *Eugnamptus*-Arten der vorletzte Punktstreifen an der Seite der Flügeldecken parallel dem Randstreifen bis zur Spitze läuft, ist er bei der zu dieser Untergattung gehörigen Art kurz vor der Mitte in der Nähe der Hinterhüften abgekürzt und vereinigt sich hier mit dem Randstreifen. Die Spitze des Epistoms ist sichtbar und tritt trennend zwischen die Hinterhüftsegmente und Flügeldecken.

Eugnamptus (Eugnamptobius) insularis sp. nov.

Kopf länger als breit; Punktierung kräftig und runzlig. Behaarung auf dem Scheitel fein anliegend, dazwischen länger aufstehend. Rüssel so lang wie der Kopf, kräftig gebogen, auf dem Rücken glänzend gekielt, seitlich runzlig punktiert. Fühler kurz hinter der Mitte des Rüssels eingelenkt; Fühlerschaftglied etwa dreimal so lang wie breit, schwach keulenförmig; das erste Geisselglied länglich oval, halb so lang wie das Schaftglied;

das zweite und dritte Glied schwach, langgestreckt; die nächsten Glieder zur Spitze allmählich an Stärke zu- und an Länge abnehmend. Keule langgestreckt; das zweite Glied kürzer als das erste; das dritte Glied am längsten. Halsschild etwas länger als breit, seitlich schwach gerundet, vor dem Vorderrand abgeschnürt; Punktierung sehr kräftig und dicht. Flügeldecken seitlich parallel. Punkte der Streifen kräftig und dicht, Spatien schmal und gewölbt, feiner punktiert. Decken in der Höhe der Hinterhüften etwas ausgeschweift, Spitze des Epistoms sichtbar und der vorletzte Streifen abgekürzt. Episternum der Hinterbrust kräftig, dicht und runzlig punktiert.

Färbung blauschwarz, Fühler gelbrot, Keule geschwärzt. Behaarung gelblich, doppelt: lang abstehend, struppig und kürzer, halbaufgerichtet.

Länge, 4.2 Millimeter.

PENANG (*13930*), 1 Weibchen.

ILLUSTRATIONEN

TEXTFIGUREN

FIG. 1. Karte der Philippinen mit eingetragenen Sammelpunkten.
2. *Scolocnemus pilosiusculus* sp. nov.
3. *Deporaus* (*Platyrhynchites*) *basalis* sp. nov.

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PHILIPPINE PARASITES OF THE FAMILY TRIGONALIDÆ

By S. A. ROHWER

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In 1874 Westwood described a species of *Trigonalys* from Mindanao. Since then no other species has been recorded from any of the Philippine Islands. Recently Prof. C. F. Baker has forwarded three specimens of trigonalids for identification. These were collected at Surigao, Mindanao, and represent two species. One of them is the species that Westwood described, and the other two represent a curious new genus of the subfamily Nomadininæ, which has been named after Professor Baker and is described herewith.

Genus **BAKERONYMUS** novum

Genotype, *Bakeronymus typicus* sp. nov.

Belongs to the subfamily Nomadininæ Schulz and may be separated from the only other genus of the group by the number of antennal joints, shape of the head, etc.

Male (*female unknown*).—Antenna 14-jointed, thickening apically, joints without tyloiden; head transverse, seen from in front more than two times as broad as high, smooth and shining; eyes very large, occupying the entire side of head, their inner margins distinctly converging below; antennæ inserted about one-fourth the distance from the lower margin of head, separated from each other by a distance twice as great as the distance from one antenna to inner eye margin; clypeus small, not defined dorsally, inserted between the antennæ, so if its dorsal

margin were defined it would about touch a line drawn tangent to the dorsal margin of the antennal fossæ; labial palpi 2-jointed, the joints long; maxillary palpi 4-jointed, the basal joint very small, the three following elongate; mandibles large, with four inner teeth, inserted much dorsad of a line drawn tangent to the lower margin of the eyes, their fossæ separated from the antennal fossæ by a narrow strip of chitin; thorax distinctly sculptured; notauli complete; mesepisternum divided by a transverse suture; propodeal spiracle short oval; legs slender; hind basitarsus subequal in length with the following joints; venation similar to *Nomadina* as figured by Schulz; abdomen depressed, flat dorsally, somewhat angulate ventrally; sternite without protuberances.

Bakeronymus typicus sp. nov.

Male.—Length, 7.75 millimeters. Third antennal joint distinctly shorter than the fourth, which is longer than the fifth or sixth; fifth and sixth subequal in length; head with a broad median impression, which extends from the clypeus to the occiput; on the vertex this impression forms a broad U-shaped area; impression narrowest at the anterior ocellus, which is situated in it and occupies most of the width of the impression; thorax coarsely coriaceous; suture in front of scutellum feebly foveolate; abdomen finely shagreened, especially apically, first two segments slender, the first nearly parallel-sided, the second gradually widening posteriorly. Black; scape, spot on mandibles, mark on clypeus, inner margins of eyes broadly and connected with an oblique line extending to lateral ocelli, an elongate spot above each antenna, posterior orbits, spot on occiput medianly, spot on dorsal angle of pronotum, spot on side of pronotum, anterior lateral angles of prescutum, scutellum except oblique lateral face, most of metanotum, posterior portion of propodeum, oblique line on mesepisternum, poorly defined bands of tergites 2 to 5 inclusive, poorly defined bands on sternites 2 to 4 inclusive yellow; legs yellowish, four posterior coxæ except lateral spot, most of four hind femora, apical two-thirds of hind tibiæ, and hind tarsi except base black; wings hyaline with a distinct cloud in the radial cell; venation pale brown.

The paratype has a lateral spot on the first sternite and the bands on the third and fourth sternites interrupted medianly. The paratype also differs in venation, but it agrees so perfectly in other important characters that I believe the venation is abnormal. The difference is: The presence of the second intercu-

bitus, thus forming a small second cubital cell instead of a large one as in the type and the complete absence of the third intercubitus.

Type locality.—Surigao, Mindanao, Philippine Islands.

Type.—Catalogue No. 24728, United States National Museum.

Described from two males (one type) received from C. F. Baker.

Lycogaster lachrymosa (Westwood).

Trigonalys lachrymosa WESTWOOD, Thesaurus Ent. Oxoniensis (1874) 123, pl. 23, fig. 5.

Lycogaster lacrimosa SCHULZ, Gen. Ins. fasc. 61 (1907) 12.

This species was originally described from material collected by Semper in Mindanao. Professor Baker has forwarded a female from Surigao, Mindanao, which agrees well with the original description.

SOME MALAYAN APHIDIDÆ

By Ryoichi Takahashi

Of the Entomological Laboratory, Department of Agriculture, Government Research Institute, Formosa

The Malayan Aphididæ recorded in this paper are represented by specimens sent to me by Mr. S. Kiyatake, who collected them in the vicinity of Johore. I here express my sincere thanks to Mr. Kiyatake for this material. Only about ten species of aphids have been recorded from the Federated Malay States, and most of them were described from Singapore by P. van der Goot.[1]

THE KNOWN MALAYAN APHIDIDÆ

Macrosiphoniella citricola v. d. G.
Fullawayella varicola (v. d. G.).
Aphis bambusae Full.
Aphis malvoides v. d. G.
Greenidea roepkei (v. d. G.).
Glyphinaphis bambusae v. d. G.
Oregma muiri v. d. G.
Oregma rhapidis v. d. G.
Oregma singaporensis v. d. G.
Oregma sundanica v. d. G.
Cerataphis lataneae (Boisd.).

SPECIES OF APHIDS COLLECTED BY S. KIYATAKE, IN THE VICINITY OF JOHORE, MALAY PENINSULA

Aphis gossypii Glover.

Many wingless viviparous females and nymphs of winged ones were collected on *Hibiscus rosa-sinensis* in September and December, 1920. Hitherto unrecorded from the Malay Peninsula.

Aphis medicaginis Koch.

Many wingless viviparous females were collected on a plant of the Leguminosæ in March, 1921. Hitherto unrecorded from this peninsula.

Aphis shirakii Takah.

Special Bull. Agri. Expt. Sta. Formosa 20 (1921) 58.

Some wingless and winged viviparous females were collected on the leaves of *Melastoma candidum* in December, 1920. The specimens sent by Mr. Kiyatake exactly agree with the Formosan ones. In Formosa this species is very common. Hitherto unrecorded from the Malay Peninsula.

[1] Tijdschrift voor Entom. 60 (1918) 112–127.

Genus **SETAPHIS** van der Goot

Cerciaphis THEOBALD, Bull. Entom. Research 11[1] (1920) 70, is a synonym of *Setaphis* v. d. G.

The species of this genus have been found in Java, Africa, and the Malay Peninsula, but no species is known to occur in Formosa.

Setaphis viridis v. d. G.

Contrib. à la Fauna des Indes néerland 1[3] (1918) 158.

Mr. Kiyatake collected some wingless viviparous females and a nymph of the winged form on an unknown plant in March, 1921. The specimens from Johore differ slightly from the original description as follows:

Wingless viviparous female.—Yellowish green; antennæ pale yellowish green, with the apex of the fourth joint and the fifth dusky; legs and abdominal tubercles pale yellowish green; eyes dark reddish (color notes from specimens preserved in alcohol); body oval, lacking hairs; head provided with a few very small hairs; front wide; frontal tubercles almost absent; eyes very small, composed of three facets; antennæ short, 5-jointed, imbricated, with three or four very small hairs; the third joint lacking sensoria; the fourth with a circular apical sensorium of medium size; the relative length of joints as follows: III, 50–52; IV, 25–30; V, 37 (22+15)—41 (23+18). Rostrum somewhat stout, reaching the middle coxæ; body lacking lateral tubercles; spiracles not protuberant. Abdomen just above the cauda provided with a pair of long and slender, hornlike tubercles, projecting horizontally far beyond the caudal apex, which is a little shorter than the fifth antennal joint, striate, slightly curved, sharply pointed and almost twice as long as the hind tarsi, provided with a short bristle at the apex; cornicles very short, cone-shaped, of lachnid appearance, slightly striate, provided with one or two very small bristles; cauda not distinct, with some rather long, very stout bristles; legs provided with a few short bristles, tarsi rather short, roughly imbricated, with very long bristles at the apex. Length of body, 1.9 millimeters; antennæ, 0.9.

This species is hitherto unrecorded from the Malay Peninsula.

CHRYSOMELIDEN DER PHILIPPINEN, III

Von J. Weise

Herischdorf, i. Riesengebirge, Germany

Die hier besprochenen Tiere erhielt ich durch Herrn C. F. Baker, College of Agriculture, University of the Philippines in Los Baños, welcher seit mehreren Jahren gründlich und mit bestem Erfolge die dortigen Coleopteren sammelte und zur Zeit wohl einen grossen Teil der im nördlichen Luzon vorkommenden aufgefunden haben dürfte.

Lema globicollis Baly ab. albidipennis ab. nov.

Mir liegt zwar augenblicklich kein ostindisches Stück der Art zum Vergleiche vor, doch glaube ich nicht zu irren, wenn ich die Philippinenform dazu stelle. Sie hat nicht dunkelblaue sondern weissliche Flügeldecken, mit einem braunen, metallisch blau überflogenen und auf die Nahtkante beschränkten Saume. Das Halsschild hat keine Seitengruben sondern dicht vor der Basis eine breite, mässig tiefe Querrinne, die aussen verbreitert und verflacht ist. Sie ist äusserst dicht und fein punktirt, die Scheibe vor ihr auf einem weiten Raume über den Vorderecken, am Vorderrande und auf zwei bis drei Längsreihen in der Mitte stark punktirt, so dass nur zwei Längsstreifen übrig bleiben, welche hinten äusserst fein punktirt, vorn fast glatt sind.

Luzon, Laguna, Los Baños.

Lema concinnipennis Baly.

Lema haemorrhoidalis Weise, Horae Soc. Ent. Ross. (1889) 57.

Ein sehr kleines Exemplar, bei dem das Halsschild sehr fein und ungleichmässig punktirt und der Bauch mit Ausnahme des vorderen Zipfels am ersten Segmente bräunlich rot gefärbt ist.

Mindanao, Iligan.

Lema torulosa Lacordaire.

Bei einem vielleicht frischen Exemplare ist der Körper rötlich gelbbraun, nur Schienen und Tarsen sind angedunkelt. Die Art ist der folgenden ausserordentlich nahe verwandt.

Luzon, Laguna, Los Baños (*288*).

Lema coromandeliana Fabricius.

Diese Philippinenform (var. *philippina*), hat die Seitenstücke der Mittel- und Hinterbrust stets so hell gefärbt wie die übrigen Teile der Unterseite, und bei dem Männchen einfache Mittelschienen. In der ab. *rufipes* sind auch die Beine rot, die Schienen an der Spitze leicht, die Tarsen stärker angedunkelt.

LUZON, Laguna, Los Baños, Mount Maquiling; Tayabas, Malinao.

Lema cyanoptera Lacordaire.

Die Stücke sind 6 bis 7 Millimeter lang, dunkel rostrot bis rotgelb, die Spitze der Schienen und die Tarsen meist angedunkelt. Fühler blass gelb, an der Basis mehr oder weniger weit bräunlich rot, Flügeldecken metallisch dunkelblau bis bläulich grün, Seitenstücke der Mittel- und Hinterbrust dicht weisslich behaart. Thorax länger als breit, hinter der Mitte mit einer feinen, deutlichen Querfurche, die an den Seiten in eine mässig breite, glatte, oben von einer Kante begrenzte Quergrube abfällt und die Seiten tief einschnürt. Letztere erweitern sich davor bis zur vorderen Borstenpore nur mässig in schwachem Bogen und sind dann schnell gerundet-verengt. Die Scheibe erscheint glatt, hat aber etwa vier weitläufige und sehr unregelmässige Längsreihen von Pünktchen in der Mitte. Die Reihen der Flügeldecken bestehen vorn, bis zu dem schwachen Quereindrucke hinter der Basis, aus stärkeren, weitläufig gestellten, dahinter aus dichter stehenden feinen Punkten und gehen vor der Spitze, an den Seiten schon hinter der Mitte, in Punktstreifen über.

Bei einer Abänderung von Cagayan auf Mindanao (*4673*), hat die Spitze der Flügeldecken einen ziemlich breiten rotgelben Saum, dessen vordere Grenze einen concaven Bogen bildet; die Schienen sind mit Ausnahme der äussersten Basis schwärzlich, die Tarsen aber rotgelb, nur das Klauenglied angedunkelt = ab. *semperi* Jacoby.[1]

LUZON, Laguna, Los Baños: Tayabas, Malinao, *670*.

Lacordaire gibt zwar die Länge der *Lema cyanoptera* mit $3\frac{2}{3}$ lin. = 8.3 Millimeter, und Jacoby die von *semperi* mit 2.5 lin. = 5.6 Millimeter an; trotzdem halte ich beide für dieselbe Art, die an dem verhältnissmässig schmalen, an der vorderen Borstenpore abgerundeten Halsschilde zu erkennen ist.

[1] Ann. Belg. (1893) 267.

Lema bakeri sp. nov.

Sat elongata, flavo-ferruginea, nitida, pectore, abdominis basi plus minusve et femoribus posticis nigris, tibiis infuscatis. Prothorace pone medium transversim sulcato et valde coarctato, antrorsum fere rectilineatim dilatato, dorso medio subtilissime subseriatim punctulato, elytris subtiliter striato-punctatis, intra basin obsolete transversim impressis, serie abbreviata fere nulla. Long., 5.5 ad 7 mm.

LUZON, Laguna, Los Baños, Mount Makiling, Mount Banahao.

Ab. *a*. Pedibus fulvis, femoribus posticis macula nigra.

Ab. *b*, juvenilis. Corpore subtus pedibusque omnino fulvis (*1449*).

Ab. *c*, tincta. Ut in *b*, sed elytris (apice excepto) vittisque duabus abbreviatis prothoracis nigris (*279*).

In der Färbung sehr veränderlich, sonst aber in Form, Grösse, und Skulptur mit *Lema cyanoptera* übereinstimmend, von ihr durch das tiefer eingeschnürte, davor stärker und fast gradlinig bis zur vorderen Borstenpore erweitert und hier fast abgestutzte Halsschild zu unterscheiden. Der Körper ist glänzend und hell gelblich rot, Seiten der Mittelbrust, die Hinterbrust, das erste und die Seiten der zwei oder drei Bauchsegmente nebst den Hinterschenkeln schwarz, die Schienen und zuweilen auch die Spitze der Mittleschenkel angedunkelt. Bei der Abänderung *a* ist von der schwarzen Farbe der Hinterschenkel nur noch eine Längsmakel in der Basalhälfte der Aussenseite übrig geblieben; sie leitet zu der hellsten Form, der ab. *juvenilis* über, deren Körper einfarbig gelblich rostrot gefärbt ist. Die dunkelste Form, die ab. *tincta*, hat auf dem Thorax vor der Querfurche jederseits eine schmale schwarze Längsbinde, welche den Voderrand nicht erreicht; ebenso sind die Flügeldecken schwarz, mit einem breiten, vorn ziemlich gradlinig begrenzten gelben Spitzensaume. Bei einem Stücke ist die Unterseite nebst den Beinen einfarbig hell gefärbt; ein anderes hat eine schwarze Quermakel jederseits auf der Hinterbrust, sowie einen kleinen gerundeten schwarzen Fleck an der Aussenseite der Hinterschenkel vor der Spitze.

Tabelle der Lema-Arten.

1. Augen nicht ausgerandet, Thorax stark punktirt, dicht vor der Basis durch eine schmal muldenförmige, an den Seiten verbreiterte und verflachte Querfurche schwach eingeschnürt, ohne Seitengruben. Ostindien, Philippinen..... **L. globicollis Baly.**
1. Augen tief ausgerandet, Thorax hinter der Mitte durch eine Querrinne, die sich jederseits zu einer Grube ausbildet, kräftig eingeschnürt.... 2.

2. Auf dem glatten Thorax liegt vor der normalen Querfurche eine zweite, die oft in der Mitte verflacht oder unterbrochen ist..... 3.
2. Halsschild nur mit der normalen Querfurche, vor dieser in drei bis vier unregelmässigen Längsreihen fein oder äusserst fein punktirt..... 4.
3. Stirn gelblich behaart, Flügeldecken rot oder rotbraun, einfarbig oder an der Seite mit einer schwarzen bis dunkelblauen Längsbinde, die sich nach hinten allmählich verbreitert und in zwei Drittel der Länge die Naht erreicht. Philippinen..... **L. torulosa** Lacordaire.
3. Stirn weisslich behaart, Flügeldecken schwarz, violett, blau oder grün. Ostindien, Hinterindien, Sunda Inseln, Philippinen. **L. coromandeliana** Fabricius.
4. Fühler schwarz, Stirnbeulen punktirt und behaart, Seitengruben des Thorax punktirt, abgekürzte Punktreihe der Flügeldecken vertieft, aus starken Punkten gebildet, die von denen der benachbarten Reihen kaum verschieden sind; sie endet in einer grubenförmigen Vertiefung neben der Naht. China, Japan, Philippinen.... **L. concinnipennis** Baly.
4. Fühler gelb, Stirnbeulen kahl und nebst der Seitengrube des Thorax glatt, abgekürzte Punktreihe der Flügeldecken kaum bemerkbar; sie besteht aus verloschenen Pünktchen unmittelbar neben der Naht und läuft bis zu dem schwachen Quereindrucke hinter der Basis fort..... 5.
5. Die Seiten des Halsschildes verbreitern sich vor der Einschnürung mässig und sind an der vorderen Borstenpore abgerundet. Philippinen ..... **L. cyanoptera** Lacordaire.
5. Halsschildseiten vor der Einschnürung fast gradlinig stark erweitert, sie bilden an der vorderen Borstenpore einen Winkel, der kleiner als ein rechter ist. Philippinen..... **L. bakeri sp. nov.**

Crioceris distigma sp. nov.

Ferruginea, nitida, pectore, abdomine pedibusque quatuor posticis nigris, antennis sat brevibus flavescentibus, scutello glabro, elytris basi evidenter-, postice subtilius striato-punctatis, singulo ante medium puncto magno nigro. Long., 8 ad 9 mm.

LUZON, Laguna, Los Baños (*275, 1586*).

Crioceris unipunctata Lacordaire.

Crioceris unipunctata LACORDAIRE, Mon. (1845) 574; BALY, Trans. Ent. Soc. London (1865) 35.

Ab. *a*. impicta. Puncto nigro elytrorum nullo.

Ab. *b*. Ut in *distigma*, sed pectore, abdomine pedibusque ferrugineis.

Die *Crioceris unipunctata* Fabricius von Java hat die Fühler, Unterseite, und die vier verdickten Hinterschenkel schwarz, kann also nicht die Philippinen-Art sein.

Crioceris luzonica sp. nov.

Ferruginea, nitida, antennis sat elongatis, nigris, tibiis infuscatis. Prothorace subcylindrico, medio eo arctato, dorso laevi uniseriatim punctulato, scutello glabro, elytris striato-punctatis,

intervallis laxe uniseriatim punctulatis, vix rugulosis, externis convexiusculis. Long., 6.5 mm.

LUZON, Mount Banahao.

Die kleinste Art der Philippinen und die einzige bei welcher die Punktreihen der Flügeldecken hinter dem leichten Quereindrucke nur wenig schwächer als davor, in ihrer ganzen Länge sehr deutlich, die Zwischenstreifen mit einer weitläufigen Reihe feiner Pünktchen und mit kleinen verloschenen Runzeln versehen sind, wodurch die Scheibe einen geringeren Glanz erhält. Rostrot, die Schienen, das letzte Tarsenglied nebst den Klauen, und ein unbestimmter Fleck auf dem Rücken der vier Hinterschenkel schwärzlich, die Fühler schwarz, Glied 1 pechbraun. Die Fühler sind etwa halb so lang als der Körper und die einzelnen Glieder vom fünften ab viel länger als breit. Thorax cylindrisch, in der Mitte eingeschnürt, an der vorderen Borstenpore abgerundet und hier kaum so breit wie an der Basis, glatt, vorn mit einer ziemlich weitläufigen Längsreihe von Pünktchen.

Crioceris gracilicornis sp. nov.

Ferrugineo-rufa, nitidissima, abdomine antennisque flavescentibus, his in basi, femoribus in disco apicem versus, tibiis tarsisque infuscatis, scutello pubescente, elytris ante medium nigris, laevibus, basi striato-punctatis. Long., 7, mm.

MINDANAO, Agusan, Butuan.

Durch schlanke Fühler ausgezeichnet, die wenigstens zwei Drittel der Körperlänge erreichen, ziemlich dünn und nur leicht zusammengedrückt sind; ihre Glieder 5 bis 8 sind eine Spur breiter wie die vorhergehenden und folgenden Glieder, das zweite ist sehr klein, 3 fast doppelt so lang, 4 wenig länger, die übrigen unter sich fast von gleicher Länge, jedes ziemlich so lang wie 3 und 4 zusammen.

Von ähnlicher Köperform als *Crioceris distigma*, nur das Halsschild vorn bedeutend breiter. Rot, stark glänzend, Bauch und Fühler gelblich, Glied 1 und 2 der letzteren rotbraun, 3 und 4 schwärzlich, der Rücken der Schenkel nahe der Spitze nebst Schienen und Tarsen angedunkelt, wenig mehr als die vordere Hälfte der Flügeldecken schwarz. Thorax quadratisch, in der Mitte durch eine glatte Quergrube jederseits eingeschnürt, auf der Scheibe glatt, mit einigen kaum sichtbaren Pünktchen die in der Mitte zwei unordentliche Längsreihen bilden. Schildchen behaart. Flügeldecken hinter der Basis leicht quer vertieft, glatt, nur die abgekürzte und die vier folgenden Punktreihen vor der Mitte vorhanden.

Crioceris ? nucea Lacordaire.

Ich bin im Zweifel ob die Exemplare von Los Baños und dem Mount Maquiling zu dieser Art gehören, da sie nur 8 Millimeter lang, hinter der Schulter etwas eingeschnürt, und auf dem Schildchen, der Mitte der Vorderbrust und den Seitenstücken der Mittel- und Hinterbrust dicht gelblich weiss behaart sind. Eine Deutung auf die hellbeinige ab. *b*. von *Crioceris distigma*, zu der die Beschreibung verleiten könnte, ist ausgeschlossen, weil Lacordaire auf dem Thorax zwei Längsreihen von Pünktchen erwähnt.

Crioceris philippinensis Jacoby.

Von Herrn Baker auf dem Mount Banahao (*2422*) und bei Baguio, Benguet (*6102*) gesammelt, ist die bis jetzt bekannte grösste Art der Philippinen und an den schwarzen Schienen, Tarsen, und Fühlern (nur das Basalglied ist gelbich rot), sowie dem weiten Quereindrucke der Flügeldecken leicht kenntlich, welcher die gegend an der Basis bedeutend emporhebt und tiefer wie bei den verwandten Arten ist. Von den beiden Punktreihen des Thorax lassen sich unter starker Vergrösserung kaum noch einige Pünktchen vor der Mitte erkennen, auch die Flügeldecken sind glatt bis auf einige Reste der ersten vier oder fünf Punktreihen in und nahe dem Quereindrucke. Ein Männchen von Baguio, Provinz Benguet, hat stark gebogene Mittelschienen und einfarbig schwarze Fühler.

Jacoby's Abbildungen [2] von *Crioceris philippinensis* und anderen Arten sind wahrscheinlich von dem Zeichner des Brüsseler Museums angefertigt, der auch meine Tafeln zu den Hispinen [3] gezeichnet hat. Sie sind unzuverlässig und nicht viel besser als die bekannten Groschen-Bilderbogen aus Neu Ruppin bei Gustav Kühn.

Alle hier besprochenen Arten haben die Seitenstücke der Hinterbrust dicht weisslich oder gelblich behaart, während daneben die Brust glatt ist.

Tabelle der Crioceris-Arten.

1. Schildchen kahl, der Thorax hat ausser einigen Pünktchen an den Seiten nur eine Reihe äusserst feiner Punkte in der Mitte..... 2.
1. Schildchen behaart, Thorax in der Mitte wenigstens mit zwei Reihen äusserst feiner, zuweilen schlecht bemerkbarer Punkte..... 3.
2. Fühler gelb, kurz, Glied 5 das längste, 8 bis 10 jedes nur so lang als breit oder wenig länger, die Punktreihen der Flügeldecken auf der inneren Hälfte vor der Mitte deutlich, aussen und hinten ziemlich erloschen. Länge, 8 bis 9 mm..... C. distigma sp. nov.

[2] Genera Insectorum 23 (1904). [3] Heft 125 (1911).

2. Fühler schwarz, lang, Glied 5 bis 10 unter sich fast gleich, jedes viel länger als breit, die Punktreihen der Flügeldecken bis zur Spitze deutlich und die äusseren Intervalle leicht gewölbt. Länge, 6.5 mm..... **C. luzonica sp. nov.**
3. Fühler sehr schlank, gelb, die Basis dunkel, von den Gliedern 5 bis 11 jedes mehr als doppelt so lang wie breit. Länge, 7 mm. **C. gracilicornis sp. nov.**
3. Fühler kräftig, von den Gliedern 5 bis 11 jedes wenig länger wie breit.. 4.
4. Fühler gelb, kaum zusammengedrückt, ihre Glieder vom fünften ab cylindrisch, dicht behaart, matt, Stirnbeule kurz dreieckig. Länge, 8 mm..... **C. ? nucea Lacordaire.**
4. Fühler schwarz (Glied 1 oft rotgelb), deutlich zusammengedrückt, Glied 1 und 2 fast glatt, glänzend, die folgenden dicht behaart, matt, 5 bis 11 jedes von der Basis zur Spitze erweitert. Stirnbeule lang. Länge, 11 mm..... **C. philippinensis Jacoby.**

Pedrillia luzonica sp. nov.

Elongata, subparallela, testaceo-flava, antennis ab articulo tertio nigris, tibiis tarsisque infuscatis, prothorace elytrisque creberrime punctatis et pubescentibus. Long., 4.5 mm.

LUZON, Mount Maquiling, Laguna (*6167*).

Schlank gebaut und fast parallel, hell rötlich gelb, Schienen und Tarsen leicht angedunkelt, die Fühler vom dritten Gliede ab schwarz, normal gebaut. Glied 1 das längste, 2 das kleinste, 3 etwas kürzer als 1, 4 und die folgenden allmählich wenig kürzer. Hals glatt, Stirn zwischen den Augen mässig dicht, sehr fein punktirt, und weisslich behaart. Halsschild nahe der Basis eingeschnürt, ohne Quereindruck, die Seiten davor gerundet, die Scheibe äusserst dicht und fein punktirt, dicht, sehr fein anliegend weisslich behaart, die Härchen nach hinten gerichtet. Flügeldecken etwas breiter als der Vorderkörper, äusserst dicht und eine Spur runzelig punktirt, ähnlich wie der Thorax aber viel kräftiger behaart. Klauen mit Basalzahn.

Aspidolopha manilensis Weise.

LUZON, Mount Banahao (*2880*).

Aspidolopha bakeri sp. nov.

Oblongo-ovalis, subtus coeruleo-nigra, sat dense brevissimeque cinereo-pubescens, palpis antennisque nigris, his basi testaceis, capite aeneo, clypeo parce punctulato, vertice magno, convexo, laevi, prothorace, scutello elytrisque laete ferrugineis, nitidis, his crebre subtiliter hinc inde subseriatim punctatis. Long., 6.5 mm.

LUZON, Mount Banahao (*2774, 4738*).

An der glänzend und lebhaft rostroten Farbe der Oberseite zu erkennen, nur der Kopf ist metallisch dunkelgrün, die Unterseite nebst den Beinen bläulich schwarz, ziemlich dicht und

zart greisbehaart. Fühler schwarz, ihre drei ersten Glieder rötlich gelbbraun. Kopfschild sparsam und verloschen punktulirt, der grosse, gewölbte Scheitel glatt, der dazwischen liegende dreieckige Raum an den Augen äusserst dicht und fein runzelig punktirt, behaart. Halsschild und das grosse dreieckige Schildchen glatt, die Flügeldecken dicht, fein, und namentlich auf der inneren Hälfte unregelmässig gereiht-punktirt. Das Pygidium ist im oberen Teile gleichmässig und schwach gewölbt, die Spitze nach vorn umgeschlagen.

Aspidolopha semperi Lefèvre.

Verhältnismässig schlank gebaut, schwarz, Halsschild und Flügeldecken gelblich rot, ersteres zuweilen mit einer Querreihe von vier dunklen Fleckchen, die Flügeldecken mit einer kleinen schwarzen Schultermakel und einem grossen Querflecke hinter der Mitte an der Naht, vom Seitenrande viel weiter entfernt. Fühler und Beine rötlich gelbbraun, die Schenkel meistens, zuweilen auch die Schienenspitze angedunkelt. Bei den mir zugänglichen Stücken ist der Clypeus glatt und hat jederseits zwei Gruben am Rande, eine grössere und tiefe oben, eine kleinere und sehr flache darunter. Da Lefèvre die Art, "late ovata" und den Clypeus "remote fortius punctatus" nennt, habe ich vielleicht nicht die richtige *Aspidolopha semperi* vor mir.

LUZON, Laguna, Mount Maquiling (*1595*).

Aspidolopha congrua sp. nov.

Oblongo-ovata, subtus testaceo-flava, griseo pubescens, metasterno antennisque fuscis, his in basi, ore, pedibus, prothorace elytrisque fulvis, nitidis, capite supra antennas nigro-aeneo, scutello maculisque quatuor in elytro singulo crebre subtilissime punctato nigris, 2, 2 collocatis. Long., 5 mm.

PALAWAN, Puerto Princesa.

Kleiner wie die vorige, auf den Flügeldecken feiner punktirt und mit je vier schwarzen Flecken versehen; der erste, auf der Schulterbeule, fast doppelt so lang als breit, der zweite, im verloschenen Eindrucke hinter der Basis, quer, von der Naht und Makel 1 ziemlich gleichweit entfernt, die beiden anderen in einer graden Querreihe hinter der Mitte, dreieckig, mit der Spitze einander zugekehrt, 3 neben der Naht, 4 nahe dem Seitenrande. Es ist sehr wahrscheinlich, dass diese Makeln bei ihrer Vergrösserung in zwei Querbinden zusammenfliessen. Der Kopf ist über der Fühlerwurzel metallisch grünlich schwarz, darunter rotgelb, der gewölbte Scheitel und der helle vordere Teil des Clypeus

glatt, der dunkle Teil desselben dicht, der etwas vertiefte und zart behaart dreieckige Raum neben den Augen viel dichter und feiner punktirt. Thorax und Schildchen glatt, Fühler angedunkelt, die ersten drei oder vier Glieder ähnlich wie die Beine rotgelb.

Aspidolopha semicincta sp. nov.

Sat oblongo-ovata, albido-lutea, subtus dense argenteo-pubescens, antennis (basi excepta), pectore, tibiis apice tarsisque nigricantibus, femoribus apicem versus, capite dense punctato, maculis binis prothoracis et tribus (1, 2) elytrorum praeterea limboque subtili pone medium nigro-aeneis. Long., 5.5 mm.

LUZON, Mount Banahao.

Ausgezeichnet durch die sehr helle Grundfarbe und die metallisch dunkelgrüne Zeichnung des Körpers, sowie durch die Skulptur der Stirn. Blass weisslich gelb, unterseits dicht und sehr kurz silberweiss behaart, Mittel- und Hinterbrust, die Spitzenhälfte der Schienen, die Tarsen und Fühler schwärzlich, die vier Basalglieder der letzteren rötlich gelb, die Seiten des Bauches leicht angedunkelt, der Rücken der Schenkel in der Spitzenhälfte, der Kopf, zwei Makeln des Thorax, das Schildchen, drei Makeln und ein feiner Seitensaum jeder Flügeldecke hinter der Mitte metallisch dunkelgrün. Jede Makel des Thorax besteht aus einem grösseren Teile dicht vor der Basis, einem breiten Querstreifen ähnlich, und einem kleineren Stücke, das vor der inneren Vorderecke aus nach vorn und innen läuft. Die erste Makel der Flügeldecken ist gross, quer, und nimmt die Schulterbeule und einen Raum dahinter ein; sie ist hinten leicht ausgebuchtet; die beiden anderen Makeln liegen in einer Querreihe unmittelbar hinter der Mitte. Sie sind kleiner, gerundet, unter sich etwas weiter entfernt wie jede vom Rande, die äussere hängt mit dem Spitzensaume zusammen. Augen und Stirn sind länger wie bei den vorigen Arten, die Stirn dicht, das Kopfschild weitläufiger und etwas stärker punktirt. Thorax glänzend, unter stärkerer Vergrösserung äusserst dicht und fein punktulirt, mit einigen grösseren Punkten dazwischen. Schildchen glatt, Flügeldecken sehr dicht, fein und teilweise gereiht-punktirt, weniger glänzend. Der Penis bildet eine gekrümmte, flach gedrückte Röhre, die am Ende gerundet-abgestutzt und mit einem kleinen winkeligen Ausschnitte versehen ist.

Bei dem Männchen der Gattung *Aspidolopha* ist das letzte Bauchsegment in der Mitte abgeflacht und sparsam behaart, beim Weibchen hat es dort eine grosse und tiefe Eigrube.

Tabelle der Aspidolopha-Arten.

1. Körper fast einfarbig metallisch blau oder bläulich grün, Pygidium neben dem aufgebogenen Seiten- und Hinterrande muldenförmig vertieft, in der Mitte zu einem dreieckigen Wulst ansteigend, dessen höchste Stelle eine schwache Längskante bildet ..... **A. manilensis** Weise.
   Hierher auch die heller gefärbte und stärker punktirte *A. philippinensis* Lefèvre.
1. Halsschild und Flügeldecken gelb bis rostrot, einfarbig oder mit dunkler Zeichnung. Pygidium in der Mitte nicht wulstartig erhöht..... 2.
2. Bauch dunkel, schwarz oder bläulich bis grünlich schwarz..... 3.
2. Bauch hell, bräunlich gelb..... 4.
3. Thorax, Schildchen, und Flügeldecken einfarbig gelblich rot, Beine schwarz und ähnlich der Unterseite bläulich metallschimmernd. **A. bakeri sp. nov.**
3. Thorax und Flügeldecken gelblich rot, in der Regel dunkel gezeichnet, Beine rotgelb, die Schenkel und zuweilen auch die Schienenspitze mehr oder weniger angedunkelt..... **A. semperi** Lefèvre.
4. Augen und Stirn lang, verhältnismässig schmal, letztere dicht punktirt, nur in der Mittellinie des Scheitels glatt..... **A. semicincta** sp. nov.
4. Stirn und Augen kurz, der grosse gewölbte Scheitel und der vordere breite Querstreifen des Clypeus glatt..... **A. congrua** sp. nov.

Aetheomorpha palawanica sp. nov.

Oblongo-ovalis, subtus flava, medio postpectoris pedibusque plus minusve infuscatis, supra fulva, nitida, antennis (basi excepta), vertice, maculis quinque limboque laterali elytrorum nigris, his antice seriatum punctatis, postice sublaevibus. Long., 4 mm.

PALAWAN, Puerto Princesa.

Länglich eiförmig, unten gelb, die Hinterbrust (ohne die Seitenstücke) schwärzlich, das Analsegment, der Rücken der Schenkel und die Spitzenhälfte der Schienen nebst den Tarsen leicht angedunkelt. Kopf und Halsschild rötlich gelb, Oberlippe und die Stirn über dem Clypeus schwarz, ebenso das Schildchen, welches aber hell gesäumt ist. Flügeldecken etwas heller und mehr gelb als der Thorax, ihre Epipleuren, ein Saum darüber und fünf Makeln auf jeder schwarz; die erste kurz, quer, bildet einen Saum an der Basis, der innen an der vierten Punktreihe endet; die zweite und dritte liegen in etwa ein Drittel der Länge; 2 ist gemeinschaftlich, klein, gerundet; 3, etwas weiter nach hinten gerückt, bildet einen Querstreifen von der fünften Punktreihe bis in den Seitensaum. Die beiden folgenden sind zu einer etwas schräg von innen nach hinten und aussen ziehenden und in der Mitte eingeschnürten Querbinde vereint, reichen bis drei Viertel der Länge und lassen eine gerundete gemeinschaftliche Quermakel vor dem schwarzen Hinterrande frei. Der Kopf ist glatt, der Clypeus bildet eine grosse sechseckige Fläche, die

durch eine Querrinne über der Mitte der Augen von der Stirn geschieden und davor winkelig eingedrückt ist. Thorax doppelt so breit wie lang, mit gerundeten Seiten nach vorn verengt, oben fast glatt, in dem Basaleindrucke vor dem Schildchen einige feine Punkte. Flügeldecken nach hinten etwas verbreitert, ziemlich kräftig in nicht ganz regelmässigen Reihen punktirt, die von der Mitte ab äusserst fein werden und hinten ganz erlöschen. Fühler schwarz, die drei ersten Glieder rotgelb, Glied 3 das kleinste, 4 fast doppelt so breit, die folgenden stark quer, nach der Spitze allmählich leicht verschmälert.

Aetheomorpha luzonica sp. nov.

Elongata, albido-flava, nitida, capite, prothorace scutelloque rufescentibus, antennis (basi excepta), vertice, sutura limboque laterali elytrorum, pectore, ano pygidioque nigris, tibiis apicem versus tarsisque infuscatis; capite prothoraceque laevibus, elytris subtiliter seriatim punctatis. Long., 3.6 mm.

LUZON, Laguna, Mount Maquiling.

Gestreckt, nach hinten etwas erweitert, mässig gewölbt, oben glänzend, unten weisslich gelb, Fühler (ausgenommen die ersten drei rostroten Glieder), Mittel- und Hinterbrust, der grösste Teil des letzten Bauchsegmentes, und das Pygidium schwarz, die Schienen nach der Spitze hin nebst den Tarsen angedunkelt. Kopf in den Augen breiter wie der Vorderrand des Thorax, rotgelb, glatt, Scheitel schwarz, Clypeus kaum von der Stirn getrennt, Augen gross, gewölbt. Thorax glatt, rotgelb, mehr als um die Hälfte breiter wie lang, nach vorn schwach und fast gradlinig verengt. Schildchen rostrot. Flügeldecken gelblich weiss, die Nahtkante und ein mässig breiter Saum am Seiten- und Hinterrande schwarz, der Rücken in fast regelmässigen Reihen fein punktirt. Erstes Tarsenglied so lang, an den Hinterbeinen länger wie das dritte Glied.

Aetheomorpha gemina sp. nov.

Elongata, flava, capite prothoraceque sublaevibus, rufescentibus, antennis apicem versus infuscatis, pygidio nigro, elytris subtilissime striato-punctatis, nigro-limbatis, limbo suturali basi et pone medium dilatato. Long., 3 ad 3.5 mm.

PALAWAN, Puerto Princesa (*4739*).

Var. *a*. Abdomine infuscato, elytris nigris, singulo maculis duabus flavis.

Der vorigen sehr ähnlich, eine Spur kurzer gebaut, Kopf und Thorax einfarbig rotgelb, ersterer in den Augen nur so breit

wie der Vorderrand des Thorax, letzterer weniger glatt, unter starker Vergrösserung ziemlich dicht verloschen punktulirt, die Flügeldecken abweichend gezeichnet. Der Kopf bildet eine Fläche die zwischen den Augen einen seichten Längseindruck besitzt. Fühler kurz, vom fünften Gliede ab stark erweitert und mehr oder weniger angedunkelt. Thorax fast doppelt so breit als lang, nach vorn verengt, die Seiten wenig gerundet. Schildchen rostrot. Flügeldecken gelblich weiss, ringsum schwarz gesäumt, der Nahtsaum am schmalsten, aber vorn dreieckig dicht hinter der Mitte makelförmig erweitert. Diese Makel dehnt sich in der var. *a* zu einer gemeinschaftlichen Querbinde aus, die in der Mitte jeder Decke verengt ist; die Flügeldecken sind nun schwarz, mit je zwei gelben gerundeten Quermakeln vor der Mitte und vor der Spitze; Brust und Bauch sind schwärzlich. Flügeldecken äusserst fein gereiht-punktirt. Das erste Tarsenglied aller Beine kürzer wie das dritte, das letzte Bauchsegment gleichmässig schwach querüber gewölbt (Männchen), oder in der Mitte mit einer weiten und nicht tiefen Eigrube (Weibchen).

Tabelle der neuen Aetheomorpha-Arten.

1. Länglich eiförmig, Flügeldecken vor der Mitte kräftig in Reihen punktirt, die dahinter fast erlöschen..... **A. palawanica** sp. nov.
1. Gestreckt, Flügeldecken fein gereiht-punktirt..... 2.
2. Augen gross, seitlich über die Vorderecken des Thorax hervorquellend, Schienen (ohne die Basis) und Tarsen dunkel..... **A. luzonica** sp. nov.
2. Augen seitlich nur so weit wie die Vorderecken des Halsschildes reichend, Beine gelb..... **A. gemina** sp. nov.

Chlamys bakeri sp. nov.

Sat elongata, atra, subopaca, antennis basi fulvis apice cum labro ferrugineis, prothorace ruguloso-punctato, medio valde gibboso, gibbere subconico, canaliculato, elytris striato-punctatis, singulo tuberculis octo, posticis duobus sat altis armato, pygidio evidenter quadrisulcato. Long., 2.8 ad 3 mm.

LUZON, Benguet, Baguio.

Das Halsschild steigt in der Mitte zu einem sehr hohen, fast konischen Höcker auf, der oben eine durchgehende Längsrinne besitzt, am vorderen Abfalle jederseits von mehreren punktirten Längsstreifen und hinten von ähnlichen unregelmässigen und kurzen Querstreifen durchzogen ist. Flügeldecken fast rechteckig, vorn am breitesten und hier kaum breiter als die Thoraxbasis, bis zur Einschnürung vor der Mitte etwas verengt, sodann parallel, am Ende bei der Betrachtung von oben grade abgestutzt, auf der Scheibe abgeflacht, in Reihen punktirt, die durch etwa acht Höcker unterbrochen und gestört werden. Die

Lage dieser Erhebungen ist ungefähr dieselbe wie bei den meisten übrigen Arten: Auf der ersten primären Rippe liegen zwei, ein kleiner nahe dem Schildchen und ein hoher in der Mitte. Die zweite, mit zwei bis drei Punktreihen besetzte Rippe, trägt vier Höcker, einen kleinen auf der vorspringenden Basis innen von der Schulterbeule und drei grössere, zwei schräg neben den Höckern der ersten Rippe, der dritte und höchste vor der hinteren Nahtecke; die beiden folgenden liegen in einer Schrägreihe mit dem zweiten Höcker der ersten Rippe und dem dritten der zweiten Rippe, der siebente ist mässig hoch, der achte höher, er verdeckt bei der Ansicht von oben die in Wirklichkeit abgerundete hintere Aussenecke der Flügeldecken; Brust und Bauch sind mit grossen, aber flachen, blatternarbigen Punkten versehen, auf dem Pygidium liegen vier weite Längsfurchen. Das kleinere Männchen ist im mittleren Teile des letzten Bauchsegmentes abgeflacht, ohne Punkte und nahe dem Vorderrande mit zwei neben einander liegenden, gekörnelten Höckern besetzt, während das Weibchen dort eine grosse, ziemlich flache Eigrube trägt.

Chlamys philippinensis sp. nov.

Sat elongata, nigra, opaca, antennis basi, palpis labroque ferrugineis, prothorace creberrime punctato, medio gibboso, gibbere transverso, subrotundato, elytris striato-punctatis, minus alte tuberculatis. Long., 2.6 ad 3.2 mm.

LUZON, Mount Banahao. LEYTE, Tacloban.

Etwas breiter gebaut wie die vorige und nicht so tief schwarz gefärbt, matt, der Höcker des Halsschildes breiter, niedriger, oben breit abgerundet und von einer breiten, flachen Längsrinne durchsetzt, alle Höcker der Flügeldecken niedrig, aber die Stücke der primären Rippen zwischen ihnen kräftiger; diese Skulptur ähnelt der von *Chlamys spilota* Baly.

Tabelle der neuen Chlamys-Arten.

1. Thorax fast so hoch wie breit, der Höcker annähernd konisch, hintere Aussenecke der Flügeldecken von oben betrachtet rechtwinkelig, die vier Längsfurchen des Pygidiums mässig tief. Oberseite rein schwarz und etwas glänzend ..... **C. bakeri sp. nov.**

1. Thorax viel breiter wie hoch, der Höcker oben gerundet, hintere Aussenecke der Flügeldecken von oben betrachtet breit abgerundet, die vier Längsfurchen des Pygidiums flach. Oberseite schwarz, matt. **C. philippinensis sp. nov.**

Coenobius coerulescens sp. nov.

Niger, supra nigro-coeruleus, nitidus, antennis basi pedibusque piceis, prothorace laevi juxta medium transversim sulcato,

basi medio triangulariter producta, elytris striato-punctatis. Long., 2.8 mm.

LUZON, Laguna, Los Baños, 1 Weibchen.

Durch die Bildung des Thorax ausgezeichnet. Derselbe ist völlig glatt, auch die normale Punktreihe an der Basis fehlt, aber der Rand ist dafür jederseits deutlich dicht und fein gekerbt und in der Mitte stark dreieckig gegen das Schildchen vorgezogen. Wenig hinter der Mitte befindet sich eine vertiefte Querlinie, die nach den Seiten hin breiter und tiefer wird, so dass letztere aus zwei gewölbten Flächen bestehen. Schildchen lang oval, glatt, hinten zugespitzt. Flügeldecken in Reihen punktirt, die siebente Reihe wie gewöhnlich sehr kurz, die achte feiner und weitläufiger als die übrigen punktirt, die zweite und dritte vorn, die neunte und zehnte gänzlich streifenförmig vertieft. Der Körper ist schwarz, Thorax und Flügeldecken dunkel blau, stark glänzend, die ersten sechs Fühlerglieder nebst den Beinen pechbraun, teilweise rötlich.

Coenobius monticola sp. nov.

Flavescens, nitidus, antennis apice leviter infuscatis, prothorace sublaevi, pone medium transversim striis basi profundis. Long., 2.5 mm.

LUZON, Laguna, Mount Maquiling, 1 Weibchen.

Blass gelb, stark glänzend, Thorax und Schenkel etwas rötlicher, das siebente bis neunte Fühlerglied an der äussersten Spitze, die beiden letzten weiter angedunkelt. Thorax wie bei dem vorigen, aber die Basis nur wenig gegen das Schildchen vorgezogen und mit einigen weitläufig und unregelmässig angeordneten Punkten besetzt, welche den Rand nicht emporheben, aber schon die regelmässige Punktreihe der folgenden Arten andeuten. Schildchen lang oval. Flügeldecken fein punktirt-gestreift, die sechs ersten Streifen nahe der Basis, die beiden letzten gänzlich stärker vertieft.

Coenobius brevicornis sp. nov.

Subovalis, niger, nitidus, antennis brevibus basi pedibusque flavis, prothorace antrorsum rotundatim-angustato, sat dense punctato, utrinque leviter transversim impresso, serie subbasali fortiter punctato instructo, elytris punctato-striatis, intervallis vix convexis, laevibus. Long., 1.8 mm.

LUZON, Laguna, Mount Maquiling, 1 Weibchen.

Kurz oval, mässig gewölbt, glänzend schwarz, die ersten sechs Fühlerglieder und die Beine rötlich gelb. Fühler kurz, jedes

der erweiterten sechs Endglieder nicht länger als breit. Kopfschild dicht und fein runzelig punktirt. Thorax fast doppelt so breit wie lang, von der Basis aus in schwacher Rundung verengt, die Scheibe ziemlich dicht punktirt, im äusseren Drittel jederseits mit einer seichten, schrägen Querrinne, hinter welcher die etwas gewölbte Fläche bis zu den Hinterecken weitläufiger punktirt ist. Die Punkte der normalen Reihe vor dem leistenförmigen Hinterrande sind wenig stärker wie die auf der Scheibe. Flügeldecken mit den Seiten des Halsschildes in einer Flucht bis vor die Mitte erweitert, sodann ähnlich verengt, hinten breit gerundet-abgestutzt, mit verrundeter Nahtecke, oben schwach gewölbt, punktirt-gestreift, die Intervalle breit, kaum gewölbt, glatt.

Diese kleine Art ist an den kurzen Fühlern, der Skulptur, und dem schwachen Seiteneindrucke des Thorax kenntlich, welcher bei der Ansicht von oben keine Einschnürung hervorruft.

Coenobius bicolor sp. nov.

Subcylindricus, niger, nitidus, capite, antennis basi, pedibus prothoraceque laete flavo-rufis, hoc sublaevi, transversim impresso, elytris punctato-striatis, intervallis haud convexis, laevibus. Long., 2.3 mm.

LUZON, Laguna, Mount Maquiling, 1 Männchen (*6136*).

Durch die Färbung, die an den japanischen *Coenobius sulcicollis* erinnert, ausgezeichnet. Der Vorderkörper nebst den fünf ersten Fühlergliedern und den Beinen ist lebhaft gelblich rot, der Hinterkörper schwarz, die Oberseite stark glänzend. Fühler schlank, von den etwas stärkeren sechs schwarzen Endgliedern ist jedes mehr als doppelt so lang wie breit. Clypeus ziemlich dicht punktirt. Thorax etwas breiter als lang, nach vorn zusammengedrückt-verengt und die Seiten nahe der Mitte durch einen Quereindruck deutlich eingeschnürt. Letzterer reicht von einer Seite zur andern, ist aber im mittleren Teile flach, an den Seiten tief. Die Scheibe ist bis auf wenige undeutliche Pünktchen vor dem Schildchen glatt; der Basalrand wird durch eine vertiefte Punktreihe leistenförmig emporgehoben, ist nebst der Punktreihe schwarz gefärbt und in der Mitte in einem sehr flachen stumpfen Winkel gegen das lang elliptische Schildchen vorgezogen. Die Flügeldecken sind ziemlich parallel, kaum breiter und nur um die Hälfte länger als das Halsschild punktirt gestreift, die glatten Intervalle fast eben, nur die beiden äusseren gewölbt.

Coenobius bakeri sp. nov. ♀.

Breviter ovalis, convexus, fulvus, nitidus, antennis gracilibus articulis sex ultimis nigris, prothorace sublaevi, utrinque profunde oblique impresso, elytris punctato-striatis, fascia basali et apicalis nigro-coerulis. Long., 3 mm.

PALAWAN, Puerto Princesa (*4740*).

Die bis jetzt bekannte grösste Art der Philippinen und durch die Zeichnung leicht kenntlich. Der Körper ist sehr kurz eiförmig, oben leuchtend gelblich rot, glänzend, unten mehr gelb, die sechs verbreiterten Endglieder der schlanken Fühler schwarz, eine gemeinschaftliche Querbinde an der Basis und Spitze der Flügeldecken metallisch dunkel blau. Die Basalbinde nimmt ungefähr das erste, die Apicalbinde das letzte Viertel der Länge ein, beide verlängern sich aber aussen (die vordere breiter wie die hintere) bis sie sich in der Mitte des Seitenrandes schmal verbinden. Clypeus stark, aber nur mässig tief und dicht punktirt. Von den sechs Endgliedern der Fühler ist jedes doppelt so lang wie breit. Thorax um die Hälfte breiter als lang, annähernd halbkugelig, jederseits mit einer tiefen Schrägfurche nahe der Mitte, welche die Seiten einschnürt; beide Furchen sind oben durch einen weiten, verloschenen Eindruck verbunden. Die vordere Hälfte ist äusserst fein, die hintere etwas stärker punktirt, die basale Punktreihe kräftig, der Hinterrand in der Mitte schwach gegen das lang elliptische Schildchen vorgezogen. In der Gattung *Coenobius* hat das Halsschild einen von der Scheibe abgesetzten, oft hell gefärbten, und von zwei (öfter punktirten) Querlinien eingefassten, tiefer liegenden Vorderrand; dieser ist in der vorliegenden Art länger wie bei den übrigen und äusserst zart quer liniirt. Flügeldecken um ein Drittel länger als das Halsschild, ziemlich fein, vorn stärker als hinten punktirtgestreift, die Intervalle einzeln äusserst fein punktulirt, fast eben, nur die drei äusseren gewölbt.

Coenobius gilvus sp. nov. ♂.

Subcylindricus, pallide flavus, nitidus, antennis gracilibus, articulis sex ultimis infuscatis, prothorace ante basin punctulato, medium versus profunde oblique impresso, elytris punctato-striatis, intervallis laevibus exterioribus subconvexis. Long., 2 mm.

PALAWAN, Puerto Princesa.

Eine kleine blassgelbe, bräunlich oder rötlich angelaufene Art mit sechs schlanken, verdickten, schwärzlichen Endgliedern der Fühler, von deren fünf hellen Basalgliedern das dritte fast so lang wie das erste ist, während die andern viel kürzer sind. Clypeus dicht runzelig punktirt. Thorax an der Basis kaum

breiter wie in der Mitte lang, nach vorn verengt, glatt, in der hinteren Hälfte nicht dicht, sehr fein punktulirt, jederseits mit einer schmalen, tiefen Schrägrinne, welche die Seiten einschnürt. Flügeldecken etwas länger wie das Halsschild, nach hinten etwas verengt, oben punktirt-gestreift, die mittleren Streifen hinten abgeschwächt, die Intervalle glatt, die inneren kaum, die äusseren deutlich gewölbt.

Coenobius flaviventris sp. nov.

Breviter-subcylindricus, niger, nitidus, prothorace postice punctato utrinque profunde et oblique impresso, elytris vix coeruleo indutis ante medium punctato-striatis, postice subtilius striato-punctatis, intervallis punctulatis, labro, antennis basi, pedibus abdomineque flavis. Long., 2.6 mm.

LUZON, Mount Banahao, 1 Weibchen (*2794*).

Breit cylindrisch, glänzend schwarz, die Flügeldecken mit einem kaum merklichen bläulichen Anfluge, die Oberlippe, die ersten fünf Fühlerglieder, Beine, und Hinterleib gelb. Fühler schlank, Glied 3 länger als 4 und so lang wie 5, die folgenden wenig länger aber etwas dicker, jedes mindestens doppelt so lang als breit. Clypeus mässig dicht punktirt. Thorax breiter wie lang, nach vorn verschmälert, jederseits mit einer Schrägfurche, welche die Seiten einschnürt, die hintere Hälfte mit Ausnahme der Mittellinie und der Seiten ungleichmässig und nicht dicht punktirt, die Punkte nehmen nach vorn an Stärke ab. Flügeldecken in den Schultern am breitesten, nach hinten wenig verengt und am Ende gerundet-abgestutzt, mit verrundeter Nahtecke, vorn punktirt-gestreift, der erste Punkt jedes Streifens grubenförmig, hinten sehr fein gereiht-punktirt, die Zwischenstreifen breit, eben, die inneren einreihig, die äusseren verworren punktulirt, der letzte schwach gewölbt.

Coenobius fulvifrons sp. nov. ♀.

Subcylindricus, niger, nitidus, capite, antennis basi pedibusque rufo-flavis, prothorace postice in medio parce punctulato, utrinque profunde oblique impresso, elytris subtiliter striato-punctatis, intervallis vix perspicue punctulatis. Long., 2.5 mm.

LUZON, Benguet, Baguio (*6132*).

Cylindrisch, glänzend schwarz, der Kopf, die ersten drei bis fünf Fühlerglieder, und die Beine rötlich gelb. Kopfschild etwas uneben, ziemlich dicht punktirt. Fühler schlank, Glied 3 so lang wie 1. Thorax kaum um die Hälfte breiter als lang, nach vorn verengt, jederseits mit einer tiefen Schrägfurche welche die Seiten einschnürt, in der Mitte der hinteren Hälfte zerstreut

und sehr fein punktulirt. Flügeldecken nach hinten unbedeutend verschmälert, fein gereiht-punktirt, der erste Punkt jeder Reihe grubenförmig, die beiden äusseren Reihen vertieft, ihre Intervalle leicht gewölbt, die übrigen abgeflacht, alle mit einer Reihe wenig bemerkbarer Pünktchen.

Coenobius pusillus sp. nov. ♀.

Breviter ovalis, niger, nitidus, labro, antennis (apicem versus infuscatis) pedibusque flavis, prothorace sublaevi, valde transverso, utrinque sat profunde impresso, elytris subtilissime punctato-striatis, intervallis sublaevibus leviter convexis. Long., 1.8 mm.

LUZON, Benguet, Baguio (*6131*).

Kurz oval, mässig gewölbt, schwarz, glänzend; Oberlippe, Beine, und Fühler gelb, letztere mässig lang, die Glieder vom zweiten ab unter sich an Länge ziemlich gleich, aber 2 dick, 3 bis 5 sehr dünn, die folgenden verbreitert, 6 bis 8 an der Spitze, die folgenden gänzlich angedunkelt. Kopfschild rotbraun, klein, fast glatt. Halsschild doppelt so breit wie lang, nach vorn in schwacher Rundung verengt, oben ziemlich glatt, nur in der Mitte vor dem Hinterrande einzeln und verloschen punktulirt, davor jederseits mit einer ziemlich kurzen und mässig tiefen Schrägfurche, welche die Seiten leicht einschnürt. Flügeldecken an den Seiten leicht gerundet, mindestens doppelt so lang wie das Halsschild, äusserst fein punktirt-gestreift, Intervalle glatt, eben, die drei äusseren gewölbt.

Coenobius ingenuus sp. nov. ♂.

Subcylindricus, niger, nitidus, antennis basi, labro pedibusque flavis, prothorace minus dense evidenter punctulato transversim impresso, elytris striato-punctatis. Long., 2 mm.

PALAWAN, Puerto Princesa.

Schlanker gebaut wie die vorige, schwarz, glänzend; Oberlippe, die ersten fünf Fühlerglieder, und die Beine gelb. Fühler schlank, jedes der sechs Endglieder fast doppelt so lang wie breit. Halsschild quer, nach vorn allmählich verschmälert, nicht dicht fein punktirt, die Punkte etwas kleiner wie die der Basalreihe. Hinter der Mitte liegt eine feine Querrinne, die an den Seiten tiefer wird und etwas nach vorn biegt. Flügeldecken wenig breiter wie das Halsschild, nach hinten eine Spur verengt, fein punktirt-gestreift, die Reihen bis zur Spitze deutlich, ihre Intervalle kaum gewölbt.

Tabelle der Coenobius-Arten.

1. Thorax ohne Punktreihe vor der Basis, diese nicht leistenförmig..... 2.
1. Thorax vor der Basis mit einer vollständigen und regelmässigen vertieften Punktreihe welche den Basalrand leistenförmig emporhebt.... 3.
2. Halsschild und Flügeldecken dunkel blau, ersteres glatt. Länge, 2.8 mm ..... **C. coerulescens sp. nov.**
2. Oberseite gelb, vor der Thoraxbasis einige Punkte welche die normale Punktreihe andeuten. Länge, 2.5 mm..... **C. monticola** sp. nov.
3. Fühler auffällig kurz, nur die Hinterecken des Thorax erreichend, letzterer ziemlich dicht punktirt. Länge, 1.8 mm.
C. brevicornis sp. nov.
3. Fühler schlank, die Hinterecken des Thorax bedeutend überragend.... 4.
4. Flügeldecken hell gefärbt mit zwei gemeinschaftlichen dunkelblauen Querbinden. Länge, 3 mm..... **C. bakeri sp. nov.**
4. Flügeldecken einfarbig ..... 5.
5. Körper einfarbig gelb. Länge, 2 mm ..... **C. gilvus** sp. nov.
5. Körper anders gefärbt..... 6.
6. Vorderkörper und Beine gelblich rot, Hinterkörper schwarz. Länge, 2.3 mm ..... **C. bicolor** sp. nov.
6. Thorax und Flügeldecken einfarbig schwarz ..... 7.
7. Bauch und Beine gelb. Länge, 2.6 mm..... **C. flaviventris** sp. nov.
7. Bauch schwarz..... 8.
8. Beine schwarz, nur die Vorderbeine, die Spitze der vier Hinterschienen und die Tarsen gelbbraun. Länge, 2 mm.... **C. manilensis** Weise.
8. Alle Beine gelb ..... 9.
9. Kopf hell gelb. Länge, 2.5 mm..... **C. fulvifrons** sp. nov.
9. Kopf dunkel ..... 10.
10. Thorax glatt, Punktstreifen der Flügeldecken hinten verloschen. Länge, 1.8 mm..... **C. pusillus sp. nov.**
10. Thorax deutlich punktirt, Punktstreifen der Flügeldecken nach hinten wenig abgeschwächt ..... **C. ingenuus** sp. nov.

Cryptocephalus laevissimus Suffrian.

Das Männchen ist 3, das Weibchen 3.5 Millimeter lang, blass rötlich gelb, glänzend, Mittel- und Hinterbrust, selten auch noch die Grube zum Einlegen der Schenkel in die Seitenstücke der Vorderbrust schwarz, die Tarsen angedunkelt. Ein schwarzer Schulterfleck ist höchst selten vorhanden. Das kleinere Männchen hat ein in der Mitte leicht abgeflachtes Analsegment.

LUZON, Laguna, Los Baños, Mount Maquiling (*2891*).

Melixanthus intermedius Suffrian.

Die Flügeldecken haben dieselbe Farbe wie die vorige Art, aber zwei Flecke auf jeder, näher der Naht als dem Seitenrande, schimmern dunkel durch, die Zwischenstreifen sind bei dem vorliegenden Männchen hinten kaum gerunzelt und eben so

glänzend als vorn, die Schulterbeule ist innen nicht deutlich abgesetzt.

PALAWAN, Puerto Princesa (*6124*).

Melixanthus (Anteriscus) palawanus sp. nov.

Subcylindricus, ferrugineus, nitidus, subtus (femoribus exceptis) flavescens, mandibulis antennarumque articulis septem ultimis subdilatatis nigris, labro rufo, elytris ante medium subtiliter striato-punctatis, postice sublaevibus. Long., 4.2 mm.

PALAWAN, Puerto Princesa.

Einem *Melixanthus cryptocephalus* im Körper- und Fühlerbau ähnlich, aber die Klauen mit einem Basalzahne. Cylindrisch, unten bräunlich gelb, Schenkel und Oberseite rostrot, glänzend, Oberlippe dunkel rot, Mandibeln und die erweiterten sieben Endglieder der Fühler schwarz. Clypeus von der Stirn undeutlich geschieden, beide bilden eine fast ebene Fläche und sind fein und zerstreut punktirt; die Stirn hat in der Mitte ein Grübchen. Halsschild fast halbkugelig, um die Hälfte breiter als lang, fast glatt. Flügeldecken vor der Mitte fein in regelmässigen Reihen punktirt, welche dahinter allmählich immer feiner werden.

Melixanthus (Anteriscus) bakeri sp. nov.

Subcylindricus, subtus fulvus, antennis articulis septem ultimis nigris, supra coeruleus subaeneo-micans, nitidus, elytris striato-punctatis, singulo fascia fulva ante medium. Long., 5.3 mm.

LUZON, Mount Banahao (*2881*).

Etwas grösser, namentlich breiter wie die vorige, unten rötlich gelb, die erweiterten sieben letzten Fühlerglieder schwarz, oben gesättigt metallisch blau, bei gewissem Lichte grünlich überflogen, glänzend, jede Flügeldecke mit einer gelblich roten Querbinde. Von dieser liegt nur ein sehr schmaler Streifen hinter der Mitte, der grössere Teil vor derselben; sie ist innen mässig breit, mit ziemlich parallelen Rändern, und reicht nahe an die Naht heran, aussen verschmälert sie sich von der sechsten Punktreihe an und endet an der zehnten Reihe. Das Kopfschild ist fein runzelig, die Stirn sparsam punktirt. Thorax quer, halbkugelig, fast glatt, unter starker Vergrösserung dicht, in der Mitte feiner als an den Seiten punktulirt. Die Punktreihen der Flügeldecken sind kräftig, regelmässig, aber in der Mitte der hinteren Hälfte bedeutend abgeschwächt.

Tabelle der Melixanthus-Arten.

1. Körper nach hinten verengt, Fühler kurz, Glied 6 bis 10 quer, Vorderhüften vom Vorderrande des Prosternums entfernt, zwischen ihnen und den Vorderecken des Thorax eine grosse, dreieckige, dicht punktirte Grube (*Melixanthus* i. sp.). Rötlich gelb, glänzend, Kopf und Thorax etwas dunkler und mehr rot gefärbt, die erweiterten sechs Endglieder der Fühler schwarz..... **M. intermedius** Suffrian.

1. Körper cylindrisch, Fühler lang, die Hinterhüften berührend, von den erweiterten Gliedern 6 bis 10 jedes länger als breit, Vorderhüften sehr schmal vom Vorderrande des Prosternums getrennt (subg. *Anteriscus*) ..... 2.

2. Oberseite lebhaft rostrot..... **M. (Anteriscus) palawanus sp. nov.**

2. Oberseite metallisch blau, eine Querbinde der Flügeldecken rot.
M. (Anteriscus) bakeri sp. nov.

Basilepta bakeri sp. nov.

Laete metallico-viridis, nitidissima, antennis nigricantibus articulis 4 primis, palpis pedibusque rufis, tarsis infuscatis in dorso viridi indutis, femoribus apice viridibus posticis subdentatis; prothorace medio minus dense, latera versus crebre et fortius punctato, lateribus angulatis, elytris infra basin profunde transversim impressis, subtilissime striato-punctatis punctis intra impressionem basalem sat fortis. Long., 4 mm.

LUZON, Laguna, Mount Maquiling (*2092*).

In Grösse und Habitus dem *Basilepta cumingi* ähnlich, aber leuchtend metallisch grün, etwas goldig schimmernd gefärbt, Mandibeln schwarz, Fühler schwärzlich, die beiden ersten Glieder nebst Tastern und Beinen gelblich rot, die beiden folgenden Glieder bräunlich rot, an den Schenkeln der abgeschnürte Spitzenteil ähnlich grün wie der Körper, auch der Rücken grünlich schimmernd, die Tarsen angedunkelt, der Bauch lebhaft goldig, an der Spitze kupferig. Fühler schlank, Glied 3 etwa so lang wie 2, doch dünner. Scheitel längsrissig punktirt, ein Raum davor, in der Mitte der Stirn, glatt, unten mit einer kurzen Mittelrinne, der untere Teil der Stirn nebst dem Clypeus nicht dicht punktirt. Thorax etwas breiter wie lang, die Seiten von der Basis bis hinter die Mitte schwach divergirend, davor stärker convergirend, beide Teile durch eine stumpfwinkelige Ecke geschieden, die Scheibe nicht dicht und stark, an den Seiten viel dichter und stärker punktirt, vorn zu einer regelmässig und dicht punktirten Querrinne abfallend, welche einen mässig breiten, glatten, tiefer liegenden Streifen am Vorderrande begrenzt. Flügeldecken breiter wie der Thorax, mit hoher Schulter- und Basalbeule, fast glatt, die Punktreihen nur in der Nähe des tiefen Quereindruckes (die sechste auch bis zur

Basis und die letzte gänzlich) tief und deutlich, sonst wie abgeschliffen und nur noch unter stärkerer Vergrösserung bemerkbar. Schenkel mässig verdickt, die hintersten fein stumpf gezähnt.

Basilepta gemmata sp. nov.

Oblongo-ovalis, sat convexa, minus nitida, subtus aenea, pedibus obscure rufis violaceo splendentibus, tarsis antennisque nigris, his basi testaceis, supra aeneo-viridis, scutello violaceo, capite prothoraceque creberrime fortius punctatis, elytris densissime foveolatim punctatis (punctis subseriatis viridi-aurichalceo splendentibus), singulo maculis duabus purpureis. Long., 3.5 mm.

LEYTE, Tacloban.

Von den übrigen Arten der Philippinen durch die sehr dichte und grobe Punktur der Oberseite abweichend. Die Unterseite ist metallisch grünlich schwarz, etwas messingglänzend, Beine rotbraun, Schenkel violett überflogen, Tarsen und Fühler schwärzlich, an diesen die vier ersten Glieder rötlich braun. Die Oberseite erscheint bei der Ansicht mit blossem Auge fast matt, aber schon bei geringer Vergrösserung treten die Gruben der Flügeldecken als goldig grün leuchtende Punkte hervor. Kopf und Thorax sind äusserst dicht, stark, und tief punktirt, die Zwischenräume bilden feine Leisten; ähnlich, nur grösser, sind die Punkte auf den Flügeldecken, die zu dicht neben einander liegenden, in der vorderen Hälfte verworrenen, dahinter fast regelmässigen Reihen geordnet sind. Das Halsschild erweitert sich von der Basis aus schwach und erreicht etwas hinter der Mitte die grösste Breite, hier biegen die Seiten plötzlich um, bilden einen zahnförmigen stumpfen Winkel und convergiren etwas stärker nach vorn. Die schwärzlich purpurfarbenen Makeln jeder Flügeldecke, eine in ein Viertel der Länge nahe der Naht, die andere dicht hinter der Mitte am Seiterrande, sind klein. Die Beine sind mässig lang, die Schenkel in der Mitte verdickt und die hintersten mit einem leicht zu übersehenden Zähnchen versehen.

Basilepta severa sp. nov.

Ovalis, convexa, subtus nigra, tibiis (basi excepta), tarsis palpisque fulvis, antennis fuscis basifulvis, capite aurichalceo vel cupreo, prothorace elytrisque coeruleo-viridibus vel coeruleis, illo fortiter punctato lateribus subrotundatis, elytris striato-punctatis, punctis pone medium evanescentibus, callo humerali et basali subpolitis, femoribus muticis. Long., 2.5 ad 3 mm.

LUZON, Laguna, Mount Maquiling; Mount Banahao (*6130*).

Durch die Färbung ausgezeichnet. Die Unterseite ist schwarz, die ersten vier Fühlerglieder, die Spitzenhälfte der Vorderschienen, die folgenden Schienen mit Ausnahme der Basis nebst allen Tarsen gelblich rot; Kopf und Vorderrand des Thorax goldig grün bis kupferrot, die Scheibe des letzteren grün schwach messingglänzend, die Flügeldecken grün mit bläulichem Schimmer bis gesättigt blau. Stirn fast glatt, Clypeus einzeln punktirt. Halsschild stark querüber gewölbt, nach vorn etwas zusammengedrückt verengt, die Seiten gerundet, die Scheibe in der Mitte mässig dicht und kräftig punktirt, nahe den Seiten dichter und viel stärker. Flügeldecken regelmässig gereiht-punktirt, die zweite und dritte Reihe sind ganz, die folgenden reichen höchstens bis zur Mitte, die Basalbeule ist fast glatt. Beine ziemlich kurz, Schenkel unbewehrt.

Basilepta assimilis sp. nov.

Ovalis, convexa, subtus nigra, pectore nigro-aeneo, palpis antennisque fulvis, his apice infuscatis, femoribus basin versus rufo-piceis; supra obscure viridi-aenea, nitida; prothorace minus dense-, latera rotundata versus crebrius et fortius punctato, elytris striato-punctatis, punctis in callo basali et in apice evanescentibus. Long., 3 mm.

Leyte, Tacloban (*4748*).

Den grössten Stücken der vorigen ähnlich, der Thorax grösser, breiter, und stärker gewölbt, und der Körper abweichend gefärbt. Unten schwarz, Taster und Fühler rötlich gelb, die vier oder fünf Endglieder der letzteren gebräunt, Schenkel an der Basis etwas gerötet, Brust und die Oberseite dunkel metallisch grün, Oberlippe schwarz. Stirn sparsam und ziemlich fein, der Clypeus dichter und stärker punktirt. Halsschild kissenartig gewölbt, an den Seiten schwach gerundet und vorn nur mässig verengt, in der Mitte der Scheibe wenig dicht und tief, an den Seiten stärker, tiefer, und dichter punktirt, etwas runzelig. Flügeldecken wenig breiter wie das Halsschild, regelmässig in Reihen punktirt, die auf der Basalbeule fast erloschen, hinter der Mitte allmählich abgeschwacht sind. Beine ziemlich kurz, Schenkel ungezähnt.

Basilepta splendida sp. nov.

Ovalis, convexa, subtus nigra, antennis (apice fuscis) pedibusque rufo-testaceis, dorso femorum apice infuscato, supra nigro-aurichalcea, nitidissima, capite prothoraceque laevibus, hoc paullo ante basin latissimo, antrorsum fortiter angustato, apice

anguste marginato, elytris striato-punctatis, punctis ante apicem evanescentibus. Long., 2.3 mm.

PALAWAN, Puerto Princesa.

An der stark glänzenden, dunkel messingfarbigen Oberseite und dem vorn sehr fein gerandeten Halsschilde stets wieder zu erkennen. Die Unterseite ist schwarz, Fühler schwärzlich, die ersten fünf bis sieben Glieder nebst den Beinen rotbraun, der Rücken der Schenkel wenigstens in der Spitzenhälfte angedunkelt, Taster rotgelb. Kopf glatt. Thorax vor der Basis erweitert und in etwa vier Fünftel der Länge am breitesten, hier abgerundet und gradlinig sehr stark nach vorn verschmälert, die Scheibe mässig gewölbt, fast glatt, doch sind bei starker Vergrösserung einzelne Pünktchen wahrzunehmen. Flügeldecken nach hinten leicht verengt, oben in regelmässigen Reihen punktirt, die auf der Basalbeule abgeschwacht, aber erst nahe der Spitze verloschen sind. Schenkel einfach.

Basilepta forticornis sp. nov.

Ovata, convexa, laete ferruginea, nitida, antennis articulis septem ultimis valde dilatatis cum mandibulis et tarsis nigris; fronte sublaevi, clypeo prothorace parce punctulatis, hoc lateribus rotundatis, elytris pone basin obsolete impressis, striato-punctatis, punctis in basi et pone medium subtilissimis, intervallis parce vix perspicue punctulatis. Long., 5 mm.

LUZON, Laguna, Mount Maquiling (*4734*).

Eiförmig, mit der grössten Breite hinter der Mitte der Flügeldecken, am Ende breit abgerundet, lebhaft rostrot und stark glänzend, die sieben Endglieder der Fühler, Mandibeln, und Tarsen schwarz. Stirn fast glatt, nur der Scheitel jederseits nahe den Augen punktirt, auch das Kopfschild mit einigen Pünktchen. Fühler kaum länger wie der halbe Körper, die vier ersten Glieder kahl, glänzend, die übrigen dicht behaart, matt, ziemlich stark erweitert, jedes um die Hälfte länger als breit, die beiden Endglieder eine Spur kürzer, Glied 3 und 4 dünn, 3 kürzer als 2 und viel kürzer als 4. Thorax um die Hälfte breiter wie lang, nahe der Mitte am breitesten und nach vorn etwas stärker wie nach hinten in gleichmässiger Rundung verengt, am Seiten- und Vorderrande glatt, auf dem übrigen Teile zerstreut, fein und verloschen punktirt. Fügeldecken mit elf regelmässigen Punktreihen und breiten, ebenen, einzeln und schwer sichtbar punktulirten Intervallen. Von den Punktreihen ist die kurze erste nebst dem hinteren Teile der zweiten und der Anfang der sechsten vertieft, die Punkte selbst sind in der Nähe des sehr flachen Quereindruckes hinter der Schulter nicht stark, an der

Basis und hinter der Mitte abgeschwächt, vor der Spitze fast erloschen.

Durch die starken Fühler, Körper- und Thoraxform von den übrigen Arten abweichend, aber wohl nicht generisch verschieden.

Basilepta luzonica sp. nov.

Oblongo-ovalis, sat convexa, testaceo-flava, nitida, prothorace medio punctulato, lateribus angulatis, elytris obsoletissime striato-punctatis, sutura infuscata. Long., 2.2 mm.

LUZON, Laguna, Mount Maquiling.

In Grösse und Körperform der *Basilepta thoracica* Lefèvre am ähnlichsten, aber durch die Thoraxform und die Skulptur der Oberseite sehr verschieden. Länglich oval und mässig gewölbt, blass rötlich gelb, der Thorax etwas mehr gerötet wie die Flügeldecken, glänzend, die Naht der Flügeldecken vorn pechschwarz, hinter der Mitte rostrot gesäumt. Kopf mit einigen zerstreuten Punkten. Halsschild vor der Basis gradlinig erweitert, sodann plötzlich etwas stärker und fast gradlinig nach vorn verengt, so dass etwas hinter der Mitte ein annähernd zahnförmiger stumpfer Winkel entsteht; die sonst glatte Oberfläche hat im mittleren Teile einige ziemlich weitläufig stehende, sehr flache aber nicht besonders feine Punkte. Auf den Flügeldecken sind die Punktreihen sehr verloschen und selbst in und neben dem Quereindrucke hinter der Basis schlecht bemerkbar, nur die erste Reihe liegt in einem feinen Streifen. Schenkel ungezähnt.

Basilepta palawanica sp. nov.

Suboblongo-ovalis, convexiuscula, testaceo-flava, nitida, prothorace laevi paullo ante basin latissimo, deinde apicem versus valde angustato, elytris subtiliter sed evidenter striato-punctatis, sutura antice brunnescente. Long., 2.3 mm.

PALAWAN, Puerto Princesa.

Etwas breiter gebaut wie die vorige, und von ihr durch die Form des glatten Halsschildes sowie die deutlichen Punktreihen der Flügeldecken bedeutend abweichend, einem kleinen einfarbigen Stücke der *Basilepta binotata* Lefèvre am ähnlichsten. Blass rötlich gelb, glänzend, die Naht der Flügeldecken vorn leicht gebräunt. Kopf und Thorax glatt, letzterer ist nahe der Basis in einer verrundeten winkeligen Ecke am breitesten, von hier nach hinten wenig, nach vorn fast gradlinig stark verengt. Die Punktreihen der Flügeldecken sind deutlich, auf

der Basalbeule abgeschwächt, nahe der Spitze verloschen, die erste Reihe liegt in einem Streifen und verbindet sich vorn durch eine regelmässige Querreihe von Punkten hinter der Basalkante mit der fünften Reihe. Beine ziemlich kurz mit einfachen Schenkeln.

Tabelle der Basilepta-Arten.

A. METALLISCH GEFÄRBTE ARTEN

1. Kopf und Halsschild **glatt, letzteres an der Spitze scharf jedoch äusserst schmal gerandet. Schwarz messingfarbig,** der grösste Teil der Fühler und die Beine **dunkel rotbraun. Länge, 2.3 mm. Palawan.**
B. splendida sp. nov.

1. **Kopf und Thorax deutlich punktirt** ..... 2.
2. Die ganze Oberseite äusserst dicht punktirt, die Punkte des Vorderkörpers stark, die der Flügeldecken grubenförmig bis hinten hin von gleicher Grösse und nur teilweise gereiht. Länge, 3.5 mm. Leyte.
B. gemmata sp. nov.

2. Flügeldecken in regelmässigen Reihen oder Streifen punktirt ..... 3.
3. Thorax dicht und ziemlich stark, nadelrissig punktirt, an den Seiten gerundet. Unten grünlich blau, oben violettblau, Oberlippe pechschwarz, Taster und Basis der schwarzen Fühler rotgelb bis rotbraun. Länge, 4.8 mm. Luzon ..... **B. philippinensis Lefèvre.**
3. Thorax nicht dicht punktirt ..... 4.
4. Halsschild an den Seiten winkelig, Basalbeule der Flügeldecken stark.. 5.
4. Halsschild an den Seiten gleichmässig gerundet ..... 6.
5. Lebhaft grün, Halsschild in der Mitte nicht dicht, an den Seiten dicht und stark punktirt, Punktreihen der Flügeldecken sehr fein, nur die Hinterschenkel mit einem Zähnchen. Länge, 4 mm. Luzon.
B. bakeri sp. nov.
5. Schwärzlich grün, Quereindruck der Flügeldecken violett, Thorax ziemlich weitläufig, die Flügeldecken stark und in Reihen punktirt, die auf der Basalbeule feiner, hinter der Mitte fast erloschen sind, alle Schenkel spitz gezähnt. Länge, 4.5 mm. Luzon.... **B. cumingi Baly.**
6. Schenkel gezähnt. Brust und Oberseite metallisch grün, Beine rötlich gelbbraun, Bauch und Basis der schwarzen Fühler rötlich gelb, Thorax weitläufig stark punktirt, jederseits mit zwei Gruben. Länge, 5.5 mm. Luzon ..... **B. semperi Lefèvre.**
6. Schenkel ungezähnt ..... 7.
7. Unterseite bräunlich rot, Oberseite glänzend violett, Thorax in der Mitte weitläufig, nach den Seiten dichter ziemlich stark punktirt, Flügeldecken hinter der Basis leicht quer vertieft, gereiht-punktirt, Punkte hinten fast erloschen. Länge, 6 mm. Luzon.
B. janthina Lefèvre.
7. Unterseite schwarz, Brust zuweilen metallisch grün ..... 8.
8. Oberseite und Brust metallisch dunkel grün. Länge, 3 mm. Leyte.
B. assimilis sp. nov.
8. Kopf und Halskragen goldgrün oder kupferrot, Thorax lebhaft metallisch grün, die Flügeldecken ebenso oder gesättigt blau, Fühlerbasis, Spitzenhälfte der Schienen, und die Tarsen rötlich gelb. Länge, 2.5 bis 3 mm. Luzon ..... **B. severa sp. nov.**

B. RÖTLICH GELB ODER ROT GEFÄRBTE ARTEN

1. Körper hinten breit abgerundet, lebhaft rostrot, Seiten des Thorax gleichmässig gerundet, Fühler ziemlich dick. Länge, 5 mm. Luzon. **B. forticornis sp. nov.**

1. Körper hinten schmal abgerundet, Fühler schlank..... 2.

2. Die grösste Breite des Halsschildes liegt etwas hinter der Mitte zwischen den stumpfwinkeligen Seiten, die nach vorn mehr als nach hinten convergiren, die Scheibe ist in der Mitte weitläufig punktirt, an den Seiten glatt; Punktreihen der Flügeldecken sehr fein. Länge, 2.2 mm. Luzon ..... **B. luzonica sp. nov.**

2. Die grösste Breite des Halsschildes liegt wenig vor den Hinterecken.... 3.

3. Thorax in der Mitte glatt, an den Seiten (ausgenommen ein Streifen am Vorderrande) dicht, kräftig, etwas runzelig punktirt. Einfarbig rötlich gelb. Länge, 2.3 bis 3 mm. Luzon..... **B. thoracica Lefèvre.**

3. Thorax glatt..... 4.

4. Thorax an der breitesten Stelle winkelig, schmal abgerundet. Rötlich gelb, Naht der Flügeldecken vorn etwas gebräunt, die erste Punktreihe läuft vorn ganz regelmässig nach aussen hinter der Basalkante und verbindet sich mit der fünften. Länge, 2.3 mm. Palawan. **B. palawanica sp. nov.**

4. Thorax an der breitesten Stelle kaum winkelig sondern breit abgerundet, die erste Punktreihe der Flügeldecken endet an der Basis und ist dort nicht mit der fünften verbunden. Rötlich gelb, die inneren Punktreihen der Flügeldecken dunkel durchscheinend, die Naht und eine Makel hinter der Basalbeule schwarz. Länge, 3 bis 3.3 mm. Luzon, Bohol. **B. binotata Lefèvre.**

Nodina luzonica sp. nov.

Subrotundata, convexa, subtus nigra, supra nigro-coerulea, nitida, antennis basi fulvis, capite aenescente minus crebre verticeque dense aciculatim punctatis, prothorace sat crebre subtiliter latera versus paullo fortius punctato, elytris regulariter striato-punctatis. Long., 2.5 mm.

LUZON, Laguna, Mount Maquiling.

Gerundet, wenig länger als breit, gewölbt, schwarz, die ersten zwei oder drei Fühlerglieder rotgelb. Kopf grünlich messingfarbig angehaucht, Thorax, Schildchen, und Flügeldecken schwarzblau, glänzend. Die Stirn ist vereinzelt und fein, der Clypeus dichter und stärker punktirt, der Scheitel längsrissig. Thorax doppelt so breit wie lang, von der Basis zur Mitte schwach, davor stärker gerundet verengt, in der Mitte der Scheibe ziemlich dicht und fein, nach dem Seitenrande hin dichter und etwas stärker punktirt. Flügeldecken in zwölf Reihen fein punktirt; die erste und elfte Reihe kurz, die neunte vorn und hinten abgekürzt, alle Reihen (mit Ausnahme der zehnten) werden hinter der Mitte feiner, bleiben aber bis zum Ende ziemlich deutlich.

Nodina santula sp. nov.

Late ovata, convexa, subtus nigra, palpis, antennis pedibusque rufo-testaceis, supra aeneo-viridis, aurichalceo-micans, nitida, prothorace minus dense subtilissime, latera sat rotundata versus crebrius et fortius punctato, elytris striato-punctatis, punctis apicem versus deletis. Long., 1.4 ad 2 mm.

LUZON, Laguna, Los Baños, Mount Maquiling; Mount Banahao (*4762, 6153*), Leyte, Mindanao.

Var. *a*. Femoribus posticis piceis.

Mit *Nodina pusilla* Motsch. am nächsten verwandt, aber der Thorax nur an den Seiten dicht punktirt. Gerundet, unten schwarz, oben metallisch dunkel grün mit Messingschimmer, stark glänzend, Taster, Fühler, und Beine rötlich gelbbraun. Kopf fein zerstreut punktirt, der Clypeus deutlich von der Stirn getrennt. Halsschild bedeutend breiter wie lang, vorn zusammengedrückt und stärker als hinten querüber gewölbt, in der Mitte wenig dicht fein punktirt, an den Seiten dichter und stärker, die Seiten sind gerundet und convergiren hinten wenig, vorn viel mehr. Flügeldecken in den Schultern kaum breiter wie der Thorax, bis zur Mitte unmerklich erweitert, dann verengt und hinten gemeinschaftlich schmal abgerundet, regelmässig gereiht punktirt. Die Punkte sind vorn fein und erlöschen hinter der Mitte allmählich, nur die beiden ersten Reihen lassen sich bis zur Spitze verfolgen. Der Ausschnitt an der Spitze der Hinterschienen ist sehr undeutlich. Zuweilen sind die Hinterschenkel pechbraun.

Tabelle der neuen Nodina-Arten.

1. Oberseite schwarzblau, Fühlerbasis rotgelb, neunte Punktreihe der Flügeldecken deutlich. Länge, 2.5 mm. Luzon..... **N. luzonica sp. nov.**
1. Oberseite grünlich schwarz bronceschimmernd, neunte Punktreihe der Flügeldecken höchstens durch einige Punkte angedeutet. Länge, 1.4 bis 2 mm. Luzon, Leyte, Mindanao..... **N. santula sp. nov.**

Phaedroides philippinensis Lefèvre.

Ein Hauptmerkmal dieser Gattung liegt in der Bildung der Vorderbrust-Episternen. Diese werden seitwärts durch eine seichte, glatte Rinne begrenzt über der ein scharf gerandeter, umgeschlagener, paralleler Längsstreifen des Thorax liegt, der wie dieser lebhaft metallisch grün gefärbt ist und vorn in eine weit über den Vorderrand der Episternen vorgezogene Spitze (die Vorderecken des Thorax) endet. Die einzige bis jetzt bekannte Art ist oberseits metallisch grün, blau oder kupferrot,

die unterseite schwarz, oft grünlich oder bläulich schimmernd, die unter sich ziemlich gleichlangen vier ersten Fühlerglieder rotbraun, die folgenden etwas verdickt, schwarz. Kopf und Halsschild ziemlich dicht und mässig fein punktirt, Flügeldecken mit kräftigen Punkten, die in ungefähr zwanzig nicht überall regelmässig Reihen gestellt sind. Besonders unregelmässig pflegt die dritte und vierte Reihe zu sein.

LUZON, Benguet, Baguio (*6122*).

Genus PAGRIA Lefèvre

Die beiden bisher auf den Philippinen gesammelten Arten verbreiten sich von Japan über die Sunda-Inseln und das Festland bis Ostindien; es sind:

Tabelle der Pagria-Arten.

1. Stirn sparsam und sehr fein punktirt, Augenrinnen breit, innen von einer hohen Kante scharf begrenzt. Thorax weitläufig, in der Mitte viel feiner wie an den Seiten punktirt. Unterseite rostrot bis pechschwarz, Fühler und Beine hell rötlich gelb, Kopf und Halsschild rotbraun, oft zum Teil angedunkelt, Flügeldecken gelb, ein Naht- und Seitensaum sowie eine Querbinde in dem Eindrucke hinter der Basalbeule schwarz. Diese Binde ist auf jeder Decke oft in zwei breite und lange Spitzen nach hinten und in eine Linie auf der sechsten punktreihe nach vorn ausgezogen. Länge, 2 bis 2.3 mm. Los Baños, Mount Maquiling (*2441*) ..... **P. signata** Motschulsky.

1. Stirn ziemlich dicht punktirt, Augenrinnen mässig breit, innen nicht scharf begrenzt, Halsschild ziemlich dicht und fast gleichmässig punktirt. Schwarz. Kopf und Thorax oft pechbraun, Fühler, Beine, und ein kurzer Längsstrich an der Basis jeder Flügeldecke innen von der Schulterbeule blass rötlich gelb. Länge, 1.8 bis 2 mm. Luzon: Los Baños, Mount Maquiling; Benguet, Baguio; Tayabas, Malinao (*6129*) ..... **P. flavopustulata Baly.**

   Aendert ab. Flügeldecken hell bräunlich gelb, einfarbig, oder ein Naht- und Seitensaum schwärzlich ..... **ab. bicolor.**

Tabelle der Scelodonta-Arten von den Philippinen.

1. Hinterbrust an der Seite mit einem kahlen, glänzenden, leistenförmigen Längsstreifen, neben dem ein ähnlicher Streifen der Episternen liegt ..... 2.

1. Hinterbrust und deren Episternen gleichmässig weisslich behaart. Oberseite einfarbig braun kupferig, glänzend. Länge, 3.5 bis 4 mm. Luzon: Los Baños (*647*), Palawan ..... **S. dillwyni** Stephens.

2. Oberseite matt, äusserst dicht runzelig punktirt, dunkel gefleckt ..... 3.

2. Oberseite glänzend, einfarbig metallisch grün, blau oder kupferig braun, Flügeldecken in Reihen punktirt, von denen die vier inneren nahe der Basis mehr oder weniger verdoppelt, die vier folgenden etwas unregelmässig, die äusseren gänzlich, und die übrigen vor der Spitze in

Streifen gestellt sind. Länge, 4 bis 4.5 mm. Mindanao: Dapitan und Iligan *(4743)* ..... **S. dispar** Lefèvre.

3. Metallisch lebhaft grün, oberseits grösstenteils mit schwarzen oder purpurfarbenen Makeln bedeckt, Schildchen, Schenkel, und Schienen leuchtend kupferrot, Tarsen schwärzlich, die ersten sechs Fühlerglieder grün, die erweiterten folgenden bläulich schwarz, Vorder- und Mittelbrust nebst dem Bauche messingfarbig. Länge, 5 mm. Luzon, Mindanao ..... **S. curculionoides** Westwood.

3. Düster schwärzlich braun mit einem blassen Metallschimmer, die ersten sechs Fühlerglieder, Schenkel, und Schienen dunkel kupferig, Flügeldecken mit drei wenig hervortretenden kupferig-schwarzen Querbinden. Länge, 4 bis 5 mm. Luzon: Los Baños *(24)*..... **S. aeneola** Lefèvre.

Pagellia sexmaculata sp. nov.

Oblongo-ovalis, subtus flava, lateribus pectoris, femoribus apicem versus basique tibiarum nigris, capite prothoraceque rufis, hoc fortiter punctato, elytris profunde punctato-striatis, nigris, singulo maculis tribus transversis flavis. Long., 2.5 mm.

LUZON, **Laguna, Mount Maquiling.**

Die kleinste und schlankste Art der Gattung. Sehr lang eiförmig, Fühler, Taster, Beine, und Bauch gelb, letzterer vorn mehr gebräunt, die Mitte der Brust rotbraun, die Seiten nebst der oberen Hälfte der Schenkel und der Schienenbasis schwarz, Kopf, Thorax, und Schildchen rot, Flügeldecken schwarz, jede mit drei gelben Quermakeln: die erste an der Basis vor dem Quereindrucke, dehnt sich über drei Intervalle von der zweiten bis in die fünfte Punktreihe aus; die zweite, unmittelbar hinter dem Quereindrucke, liegt zwischen der dritten und sechsten Punktreihe und verschmälert sich nach aussen; die dritte, vor der Spitze, ist dreieckig, vorn und innen gradlinig begrenzt, hinten und aussen zugespitzt. Kopf wenig dicht und kräftig punktirt. Halsschild so lang als breit, stark querüber gewölbt und nach vorn abfallend, an den Seiten mässig gerundet, nach vorn und hinten gleichmässig verschmälert, die Scheibe in der Mitte dicht und wenig stärker wie die Stirn, an den Seiten viel dichter punktirt. Flügeldecken an der Basis in grader Schräglinie heraustretend und in den Schultern breiter wie das Halsschild, bis hinter die Mitte wenig erweitert, dann schnell verengt und am Ende schmal gemeinschaftlich abgerundet, mit den normalen tiefen dreizehn Punktstreifen, von denen der erste und zwölfte sehr kurz sind und der neunte und zehnte, vorn verbunden, erst hinter der Schulter beginnen. Die inneren vier Intervalle sind mässig breit, gewölbt, die folgenden schmal, hoch, und scharf.

Pagellia butuanensis sp. nov.

Oblongo-ovalis, dilute testacea, nitida, prothorace latera versus subinfuscato, creberrime subtiliterque strigatim punctato, juxta marginem anticum alutaceo et parce punctulato, elytris infra basin obsoletius impressis, profunde punctato-striatis, intervallis convexis. Long., 3 mm.

MINDANAO, Butuan.

Den kleinen Stücken von *Pagellia suturalis* sehr ähnlich, hell rötlich gelbbraun, das Halsschild wenig glänzend, nach den Seiten hin etwas angedunkelt; fein und sehr dicht längsrunzelig punktirt, die Runzeln länger und kräftiger wie die von *P. suturalis*, am Vorderrande nur zart gewirkt und zerstreut punktulirt. Flügeldecken glänzend, hinter der Basis kaum merklich quer eingedrückt, tief punktirt-gestreift, mit gewölbten Intervallen, von denen das neunte bis elfte schmal und rippenförmig ist.

Pagellia suturalis Lefèvre.

Auf Luzon die häufigste Art, in der Färbung von fast einfarbig bräunlich gelb bis pechschwarz variirend, jedoch bleibt die Basalbeule der Flügeldecken blass gelblich gefärbt, selbst in den hellsten Stücken. Die mir vorliegende dunkelste Form ist pechschwarz, Fühlerbasis, Tarsen, ein Aussensaum des Bauches, und wenigstens die vordere Hälfte der Basalbeule auf den Flügeldecken rötlich gelbbraun. Die hinteren zwei Drittel des Halsschildes sind sehr dicht, fein punktirt, und kurz längsrunzelig, fast matt, ein Streifen vor der Basalrinne glatt und das vordere Drittel zart gewirkt, weitläufig punktirt, glänzend. Die Pünktchen werden nach aussen und längs des Seitenrandes stark und tief.

Die Gattung *Pagellia* ist durch die auffällig stark punktirt-gestreiften Flügeldecken und deren leistenförmige Intervalle, sowie durch die tief herabgebogenen Seiten des Halsschildes ausgezeichnet; der Punktirung nach scheint *P. foveolata* Lefèvre nicht hinein zu gehören, dagegen die *Lindinia lefevrei* Jacoby, die mit *P. suturalis* verwandt sein dürfte.

LUZON, Laguna, Mount Maquiling, Mount Banahao (*2093*).

Tabelle der Pagellia-Arten.

1. Flügeldecken mit deutlicher Basalbeule, die hinten durch einen kräftigen Eindruck emporgehoben wird ..... 2.
1. Flügeldecken hinter der Basis kaum bemerkbar eingedrückt..... 5.
2. Halsschild glänzend, stark querüber gewölbt, vorn so breit wie hinten, annähernd cylindrisch, dicht und ziemlich grob punktirt, Flügeldecken schwarz, jede mit drei blassgelben Quermakeln (1, 1, 1). Länge, 2.5 mm. Luzon..... **P. sexmaculata sp. nov.**

2. Halsschild vorn viel schmaler als hinten, auf der Scheibe abgeflacht und sehr dicht, ziemlich fein, mehr oder weniger längsrunzelig punktirt, fast matt..... 3.
3. Thorax auf einem Querstreifen vor der Basalrandlinie glatt, nahe dem Vorderrande zerstreut punktirt und nicht längsrunzelig wie auf dem dahinter liegenden Teile. Rötlich gelbbraun bis pechschwarz, die Naht und die verdickten Endglieder der Fühler schwärzlich, die Basalbeule der Flügeldecken stets heller als die übrige Scheibe. Länge, 3 bis 3.5 mm. Luzon..... **P. suturalis Lefèvre.**

Hierher vielleicht *Lindinia lefevrei* Jac., bei der die inneren Punktstreifen der Flügeldecken nahezu unpunktirt sein sollen.

3. Thorax bis an alle Ränder runzelig punktirt..... 4.
4. Halsschild am Vorderrande weniger dicht längsrunzelig punktirt wie in der Mitte. Flügeldecken rötlich braun mit einigen helleren Makeln. Länge, 3 mm. Luzon ..... **P. acuticosta Lefèvre.**
4. Halsschild in der Mitte sehr dicht und fein narbig punktirt, neben dem Vorder- und Seitenrande stärker und längsrunzelig punktirt. Flügeldecken rötlich gelb mit je drei schwarzen Makeln (1, 1, 1). Länge, 3 mm. Luzon..... **P. signata Weise.**
5. Flügeldecken gleichmässig tief punktirt-gestreift. Länge, 3 mm. Mindanao: Butuan..... **P. butuanensis sp. nov.**
5. Flügeldecken vorn in starken Reihen punktirt, hinter der Mitte fast glatt. Länge, 3 mm. Luzon..... P. foveolata Lefèvre.

Genus ICOGRAMMA novum

Corpus subovatum dense brevissimeque pubescens. Caput exsertum frons deplanata, antennae gracilis, dimidio corporis breviores, articulis 6 ultimis paullo incrassatis. Prothorax brevis, antrorsum angustatus, lateribus haud marginatis. Elytra striis punctatis circiter viginti impressa. Prosternum valde transversum, episternis antice concavis. Pedes sat graciles, femoribus parum incrassatis, muticis, tibiis quatuor posterioribus subemarginatis. Unguiculi fissi.

Mit *Malegia* verwandt, jedoch durch das sehr kurze und breite Prosternum und die enge, neben einander liegenden, ungefähr zwanzig Punktstreifen der Flügeldecken verschieden. Die Beine sind ziemlich kurz, schlank, Schenkel in der Mitte etwas verdickt, der Ausschnitt an der Spitze der vier Hinterschienen kurz und flach, dicht bewimpert.

Icogramma lineigera sp. nov.

Testacea, subopaca, dense brevissimeque albido pilosa, pedibus antennisque flavis, his apice infuscatis, elytris creberrime punctato-striatis, intervallis angustis, convexis, uniseriatum punctulatis. Long., 2 ad 2.5 mm.

PALAWAN, Puerto Princesa. LUZON, Benguet, Baguio (*4750, 6135*).

Annähernd eiförmig, mässig gewölbt, blass rötlich gelbbraun, ziemlich matt, Beine, Taster, und Fühler gelb, an letzteren die fünf Endglieder angedunkelt, der Bauch zuweilen schwärzlich. Kopf mässig gross, Stirn fast eben, äusserst zart punktulirt und anliegend weisslich behaart. Thorax breiter wie lang, nach vorn verengt, an den Seiten wenig gerundet, ohne Randleiste, stark querüber gewölbt und ähnlich wie die Stirn punktulirt, die Pünktchen aber durch die dichte anliegende Behaarung verdeckt. Die Härchen sind weisslich und von der Mittellinie schräg nach hinten und aussen gerichtet. Schildchen rechteckig. Flügeldecken in den Schultern bedeutend breiter wie der Thorax, bis hinter die Mitte ziemlich parallel, dann verengt und schmal abgerundet, auf dem Rücken dicht gestreift und in den Streifen mit einer dichten Reihe von Punkten besetzt, von denen jeder ein sehr kleines, weisses, schuppenförmiges Härchen trägt, während die schmalen, leistenförmigen Intervalle mit einer Reihe von etwas längeren, aber viel feineren und weniger hell gefärbten Härchen besetzt sind. Vorderhüften weit getrennt, das Prosternum daher kurz, breit, nach vorn und hinten abfallend.

Icogramma obscura sp. nov.

Nigra, opaca, pube grisea brevissima dense vestita, antennis (apice vix infuscatis) pedibusque flavis, elytris crebre subtiliterque striato-punctatis, intervallis latera versus convexiusculis. Long., 1.8 ad 2 mm.

PALAWAN, Puerto Princesa.

Kleiner und etwas schlanker als die vorige, oberseits gleichmässig dicht, sehr kurz und fein greisbehaart, die an der Spitze kaum angedunkelten Fühler nebst den Beinen gelb, die Flügeldecken feiner in dichten Reihen punktirt, welche innen kaum, aussen etwas vertieft und hier mit mässig gewölbten Intervallen versehen sind.

Aulexis gracilicornis sp. nov. ♂.

Elongata, pallide testaceo-flava, supra dense subtilissime et brevissime griseo pubescens, subopaca, antennis gracilibus, corporis longitudine parum brevioribus. Long., 4 ad 5 mm.

LUZON, Benguet; Baguio (*6141*).

Femina (?): Antennis nigris, articulis duobus primis flavis. Stirn nur mässig dicht fein punktirt, Kopfschild länger wie bei den übrigen Arten, wenig quer, fast quadratisch, nicht dicht und bedeutend stärker punktirt als die Stirn. Fühler des Männchens so lang wie der Körper, Glied 3 mindestens doppelt

so lang als 2 und fast so lang als 1, die folgenden unter sich ziemlich von gleicher Länge, jedes wenig länger als 3, die fünf Endglieder unbedeutend verdickt. Bei einem mit dem Männchen zusammen gefangenen Weibchen, welches ich nur fraglich zu dieser Art stellen kann, sind die Fühler etwas kürzer, die Endglieder merklich stärker, Glied 3 schwärzlich, die folgenden schwarz, von den Gliedern 6 bis 10 jedes kürzer wie Glied 4 oder 5. Thorax normal gebaut, vor dem zweiten Quereindrucke nicht dicht und äusserst fein, dahinter dichter und etwas stärker punktirt. Die Punktirung der Flügeldecken ist dichter und stärker wie die an der Thoraxbasis. Körper blassgelb mit einem leichten rötlich braunen Anfluge.

Aehnlich lange Fühler besitzt *Aulexis longicornis* Jacoby von Sumatra, aber bei ihr ist Glied 3 so kurz wie 2.

Aulexis brevicornis sp. nov.

Subelongata, flavo-rufa, sat nitida, antennis brevibus, articulis 5 ultimis incrassatis elytrisque nigris, his cum prothorace obsolete biimpresso sat crebre subtilissimeque punctatis. Long., 2.5 ad 3 mm.

PALAWAN, Puerto Princesa. Ab. *a*. Supra omnino brunneo-flava.

Eine kleine, durch den stärkeren Glanz der Oberseite und kurze Fühler ausgezeichnete Art, die sich von der ähnlichen *Aulexis pusilla* Lefèvre schon durch die schwachen, verloschenen Quereindrücke des Thorax entfernt. Weniger schlank gebaut wie die vorhergehende Art, gelblich rot, Glied 5 und 6 der Fühler angedunkelt, die folgenden Glieder nebst den Flügeldecken schwarz. Die Fühler reichen bis hinter die Schulter, Glied 2 und 6 sind klein, 4 wenig, 3 und 5 deutlich länger, die folgenden verdickt, 7 so lang wie 1, 8 bis 10 jedes kurz, an der Spitze fast so breit wie lang. Clypeus quer, sparsam, die Stirn etwas dichter punktulirt und behaart. Thorax quer, von der Basis bis zur Mitte erweitert, davor ausgerandet-verengt, die Seitenzähnchen sehr klein, verloschen, die Scheibe vorn äusserst fein, hinter der Mitte wenig stärker und nicht besonders dicht punktulirt, mit zwei angedeuteten Quereindrücken. Flügeldecken bedeutend stärker wie das Halsschild vor der Basis punktirt, jedoch weitläufiger wie in den übrigen Arten, daher glänzender als diese.

Bei der ab. *a*, die vielleicht aus nicht ganz ausgereiften Stücken besteht, ist die Oberseite einfarbig bräunlich gelb.

Aulexis flavopilosa Lefèvre.

LUZON, Mount Banahao; Paete (*2793*).

Aulexis luzonica Lefèvre.

LUZON, Laguna, Mount Maquiling: Benguet, Baguio (*6142*).

Die Gattung *Aulexis* lässt sich mit Sicherheit an dem gestreckten annähernd cylindrischen, oberseits dicht anliegend und auf den Flügeldecken ausserdem noch sparsamer aufgerichtet-behaarten Körper, sowie dem Seitenrande des Thorax erkennen, welcher nahe der Mitte in der Regel in einen dreizähnigen Vorsprung erweitert, davor ungerandet ist, während an den Seiten der Scheibe zwei Quereindrücke hintereinander liegen. Das Kopfschild endet vorn in zwei abgeflachte und durch einen bogenförmigen Ausschnitt getrennte Zähnchen, von denen jedes in eine Vertiefung der Oberlippe eingreift. Die Flügel sind schwärzlich, metallisch grün oder kupferrot überflogen. Der Hinterrand des letzten Bauschsegmentes ist entweder in der Mitte gradlinig abgestutzt oder leicht gerundet-vorgezogen (Weibchen) oder bogenförmig ausgerandet (Männchen).

Die schwer zu unterscheidenden Arten verbreiten sich von Ostindien über die Küstenländer und die Sunda-Inseln bis zu den Philippinen; ihre Grösse und Färbung scheint sehr veränderlich zu sein.

Tabelle der Aulexis-Arten.

1. Oberseite dicht und verhältnismässig lang goldgelb oder gelblich behaart, so dass die Skulptur fast ganz verdeckt wird..... 2.
1. Die Behaarung der Oberseite ist zwar dicht, aber fein, kurz, und verdeckt die Punktirung nicht..... 3.
2. Oben schwarz, unten rotbraun, Brust angedunkelt bis schwarz, Oberlippe, Taster, Fühler, und Beine rötlich gelbbraun. Länge, 4.5 bis 6 mm. Luzon, Paete..... **A. flavopilosa Lefèvre.**
2. Rotbraun, nur die sieben Endglieder der Fühler und die Flügeldecken schwarz. Länge, 6.8 mm. Philippinen..... **A. philippinensis Jacoby.**
3. Oberseite greisbehaart, Kopf und Thorax, sowie Schienen und Tarsen schwärzlich, Flügeldecken schwarz, mit dunkel grünem Metallschimmer. Länge, 6 bis 6.3 mm. Luzon..... **A. puberula Lefèvre.**
3. Flügeldecken ohne Spur eines Metallschimmers, Beine einfarbig hell gefärbt ..... 4.
4. Abgesetzter Seitenrand der Flügeldecken mässig breit, alle Härchen des Thorax gradlinig nach innen zur Mittellinie gerichtet. Länge, 4 bis 6 mm. Luzon..... **A. luzonica Lefèvre.**
4. Abgesetzter Seitenrand der Flügeldecken sehr schmal, die Härchen des Thorax vor der Mitte nach hinten, hinter derselben schräg nach vorn und innen gerichtet..... 5.
5. Fühler so lang oder wenig kürzer wie der Körper, Glied 3 mindestens doppelt so lang als 2. Einfarbig bräunlich gelb oder beim Weibchen

(?) die Fühler vom dritten Gliede ab schwärzlich bis schwarz. Länge, 4 bis 5 mm. Luzon..... **A. gracilicornis sp. nov.**

5. Drittes Fühlerglied wenig länger wie das zweite..... 6.
6. Die Fühler reichen bis hinter die Mitte der Flügeldecken. Oberseite hell braun, dicht, fein, kurz anliegend behaart, mit zahlreichen aufgerichteten Härchen. Länge, 3.5 bis 5 mm. Luzon.

A. pusilla Lefèvre.

6. Fühler nur bis hinter die Schulter del Flügeldecken reichend, ihre fünf letzten Glieder schwarz, verdickt, Glied 8 bis 10 wenig länger als breit, der übrige Körper rötlich gelb, Flügeldecken schwarz, oder die Oberseite hell braun, sehr fein und kurz greisbehaart, ziemlich glänzend. Länge, 2.5 bis 3 mm. Palawan..... **A. brevicornis sp. nov.**

Lindinia reflexoaenea Lefèvre.

LUZON, Laguna, Mount Maquiling (*4729*).

Lindinia corrugata Lefèvre.

MINDANAO, Agusan, Butuan.

Lindinia tibialis Lefèvre.

LUZON, Benguet, Baguio (*6125*).

Die Gattung *Lindinia* ist von *Rhyparida* wenig verschieden, am meisten noch habituell, indem das Halsschild an den Seiten gleichmässig gerundet und nach vorn wenig mehr als nach hinten verengt ist, ausserdem sind alle Schenkel gezähnt. Bis jetzt sind sechs Arten bekannt, die alle auf den Philippinen leben:

Tabelle der Lindinia-Arten.

1. Kopf und Halsschild völlig glatt ..... 2.
1. Kopf glatt, ebenso das Halsschild nahe dem Seitenrande, während der übrige Teil desselben deutlich und mässig dicht fein punktirt ist. Rotbraun, Fühlerbasis und wenigstens die Basalhälfte der Schenkel gelblich, Thorax, Schildchen, und Flügeldecken grünlich schwarz mit Messingschimmer, letztere in dreizehn Reihen punktirt, von denen die äusseren neun oder zehn hinter der Mitte sehr fein werden. Länge, 5 bis 6 mm. Luzon..... **L. reflexoaenea Lefèvre.**
1. Kopf und Halsschild dicht und kräftig punktirt und gerunzelt. Schwarz, wenig glänzend, Flügeldecken mit groben Punktreihen, welche grösstenteils durch fünf bis sechs Reihen von grösseren und zahlreicheren Reihen von kleineren, länglichen oder gerundeten, glatten, dunkel violetten Beulen unterbrochen und gestört werden. Länge, 3.8 bis 4.3 mm. Luzon, Mindanao..... **L. corrugata Lefèvre.**
2. Schwarz, glänzend, Kopf, Fühler, und Beine pechbraun, Flügeldecken stark punktirt-gestreift, mit gewölbten Intervallen. Länge, 4 mm. Pulo Batu ..... **L. fusconigra Lefèvre.**
2. Bräunlich bis gelblich rot..... 3.
3. Punktreihen der Flügeldecken nur in dem Postbasaleindrucke kräftig, sonst sehr fein, hinter der Mitte fast erloschen, Spitze der Schenkel nebst Schienen und Tarsen schwarz. Länge, 5.5 mm. Luzon.

L. tibialis Lefèvre.

3. Beine, Mittel- und Hinterbrust, sowie der grösste Teil des ersten Bauchsegmentes schwarz..... ab. **nigripes** Weise.
3. Punktreihen der Flügeldecken bis hinten deutlich ..... 4.
4. Wenig glänzend, Flügeldecken gereiht-punktirt mit ebenen Intervallen, Schienenspitze und Tarsen schwarz. Länge, 5.5 bis 6 mm. Luzon. **L. picitarsis** Lefèvre.
4. Ziemlich glänzend, einfarbig rotgelb, Flügeldecken punktirt-gestreift, Intervalle gewölbt. Länge, 4 bis 4.3 mm. Luzon..... **L. fulva** Lefèvre.

Rhyparida episternalis sp. nov.

Elongata-ovalis, sat convexa, lutea, nitidula, prothorace parum rufescente maculis quatuor elytroque singulo maculis tribus nigris, capite prothoraceque crebre ruguloso-, episternis prothoracis subremote punctatis, elytris punctato-striatis, seriebus nona et decima seriem unam formantibus, femoribus dentatis. Long., 3.5 ad 4 mm.

PALAWAN, Puerto Princesa (*4757*, *4759*, *4760*).

Var. *a*. Maculis prothoracis deficientibus.

Var. *b*. Prothorace elytrisque unicoloribus, luteis.

Durch zwei Merkmale ausgezeichnet: die Episternen der Vorderbrust sind nicht dicht, aber sehr deutlich und ziemlich kräftig punktirt und die normalen Punktreihen 9 und 10 der Flügeldecken sind zu einer nicht ganz gradlinigen Reihe vereint, so dass jede Decke nur zwölf Reihen zählt.

Sehr lang oval, schmutzig gelb, Kopf und Halsschild, zuweilen auch die Unterseite etwas rötlich, letztere bisweilen auch angedunkelt und die dünne Schenkelspitze schwärzlich, ebenso die Fühler vom fünften Gliede ab. Halsschild mit vier kleinen schwarzen Flecken in einer Querreihe in der Mitte und jede Flügeldecke mit drei ähnlichen: der erste auf der Schulterbeule, der zweite im Quereindrucke hinter der Basalbeule zwischen der vierten und sechsten Punktreihe, und der letzte hinter der Mitte zwischen der vierten und siebenten Reihe, etwas grösser als einer der vorderen, länger als breit. Diese Flecke verschwinden, zuerst die des Thorax (var. *a*), dann die der Flügeldecken (var. *b*). Kopf und Halsschild sind dicht runzelig punktirt, letzteres ist fast doppelt so breit wie lang und hat die grösste Breite etwas hinter der Mitte. Hier sind die Seiten stark gerundet oder leicht stumpfwinkelig, die vordere Borstenpore ist auf einem kleinen, nach aussen gerichteten, und nach der Spitze wenig verengten Kegel eingestochen. Die Flügeldecken sind punktirt-gestreift, diese Streifen auf der Basalbeule kaum, vor der Spitze deutlich abgeschwächt. Der Zahn an den Vorderschenkeln ist mässig gross, an den Hinterschenkeln kleiner, an den Mittelschenkeln sehr klein.

Rhyparida aethiops sp. nov.

Oblongo-ovalis, convexa, subtus picea vel nigra, antennis basi palpisque fulvis, capite ferrugineo, prothorace scutello elytrisque nigris, nitidis. Prothorace crebre, latera minus rotundata versus fortius et ruguloso-punctato, elytris juxta impressionem transversam punctato-striatis in callo basali et pone medium subtiliter striato-punctatis, episternis prothoracis pone medium punctatis, femoribus minutissime dentatis. Long., 4.3 ad 5 mm.

LUZON, Laguna, Mount Maquiling (*4744*).

Grösser, höher gewölbt wie die vorige, und an den Episternen der Vorderbrust zu erkennen, deren hintere Hälfte nicht dicht punktirt ist.

Länglich oval, gewölbt, unten pechbraun bis schwarz, Taster und Fühler rötlich gelbbraun oder, nebst dem Kopfe, rostrot, die verdickten Endglieder der Fühler angedunkelt, Thorax, Schildchen, und Flügeldecken tief schwarz, glänzend. Kopf fein und mässig dicht punktirt, neben den Augen gerunzelt. Thorax kaum um die Hälfte breiter als lang, an den Seiten schwach gerundet, in der Mitte der Scheibe fein und ziemlich dicht, seitwärts etwas stärker und bedeutend dichter punktirt und leicht gerunzelt. Flügeldecken breiter wie das Halsschild, in dreizehn Reihen punktirt, welche auf der Basalbeule und hinter der Mitte fein und flach, auf dem dazwischen liegenden Raume kräftig und vertieft sind. Besonders stark, viel breiter als lang, sind die Punkte im Quereindrucke. Der Zahn an den vier Vorderschenkeln its sehr klein, der an den Hinterschenkeln etwas grösser.

Rhyparida melas sp. nov.

Oblongo-ovalis, sat convexa, nigra, nitida, palpis antennisque fulvis, his apice subinfuscatis, macula frontali labroque flavotestaceis. Fronte strigoso-punctata antice et clypeo sat dense griseo-pilosulis, prothorace crebre subtiliter, latera versus fortius punctato, elytris striato-punctatis, seriebus 8 ^{vo} ad 10 ^{mo} ante medium irregularibus, femoribus anticis muticis. Long., 3.5 mm.

LUZON, Benguet, Baguio.

Länglich oval und mässig gewölbt, glänzend schwarz, Taster und Fühler rötlich gelb, die fünf Endglieder der letzteren gebräunt, ein Querfleck über dem Clypeus nebst der Oberlippe blass rostrot. Stirn dicht und fein längsrissig punktirt, ihr unterer Teil zwischen den Augen und das punktirte Kopfschild ziemlich dicht weisslich behaart. Halsschild wenig breiter als lang, an den schwach gerundeten Seiten nach vorn mehr wie nach hinten

verengt, stark querüber gewölbt und der fein abgesetzte Seitenrand weit nach unten gerückt, auf der Scheibe dicht und fein, nach den Seiten hin etwas stärker punktirt. Flügeldecken in Reihen punktirt, die in dem tiefen Quereindrucke hinter der Basis und, in grösserer Ausdehnung, nach aussen hin aus kräftigen, an den übrigen Stellen aus feineren Punkten bestehen. Die Reihen 8 bis 10 sind vor der Mitte unregelmässig. Vorderschenkel unbewehrt, Mittelschenkel mit einem sehr kleinen, die Hinterschenkel mit einem grösseren Zahne.

Rhyparida antiquula sp. nov.

Oblongo-ovalis, convexa, nigra, nitida, palpis flavescentibus, antennis fulvis, apice leviter infuscatis, capite pedibusque obscure ferrugineis, femoribus basi et apice nigris; fronte strigoso-punctata, prothorace haud transverso sat crebre subtiliter, latera versus fortius et subruguloso-punctato, elytris striato-punctatis, seriebus 8 ^{vo} ad 10 ^{mo} antice irregularibus, femoribus dentatis. Long., 5 mm.

LUZON, Benguet, Baguio.

Bedeutend grösser als die vorige, der Kopf kahl, das Halsschild etwas länger als breit, an den Seiten stärker und etwas runzelig punktirt, die Punkte in den Reihen der Flügeldecken von ziemlich gleicher Grösse, hinter der Mitte nur wenig abgeschwächt, in und neben dem mässigen Quereindrucke nicht vergrössert und vertieft, Beine dunkel rostrot, Schenkel an der Basis und Spitze schwarz. Der Zahn an den Vorderschenkeln ist der kleinste, der an den Hinterschenkeln der grösste.

Rhyparida bakeri sp. nov.

Oblongo-ovalis, convexiuscula, subtus nigra, antennis basi, palpis femoribusque (his basi et apice extremo exceptis) fulvis, pectore medio obscure viridi-aeneo, supra saturale aeneo-viridis, sat nitida, prothorace obsolete punctulato, elytris parum profunde punctato-striatis, femoribus posticis dentatis. Long., 4 mm.

MINDANAO, Butuan.

An der Färbung des Körpers und der Beine leicht zu erkennen. Länglich oval und mässig gewölbt; unten schwarz, die Mitte der Brust metallisch grün überflogen; Taster gelblich, die ersten vier bis fünf Fühlerglieder und die Schenkel rötlich gelb, aber die äusserste Basis und Spitze der letzteren schwärzlich. Oberseite gesättigt metallisch grün, zuweilen bläulich oder violett schimmernd, fettig glänzend. Kopfschild lang, sparsam und verloschen punktulirt, von der fast glatten Stirn durch eine Querfurche geschieden. Von dieser läuft eine Mittelrinne auf die

Stirn. Halsschild fast um die Hälfte breiter als lang, mit mässig gerundeten Seiten nach vorn mehr wie nach hinten verengt, der vordere Borstenkegel bildet einen kleinen, nach aussen gerichteten Cylinder. Die Scheibe ist hinten weniger als vorn gewölbt, sehr fein und verloschen punktulirt, nahe den Seiten glatt. Die Flügeldecken besitzen einen schwachen Quereindruck hinter der Basis und sind fast gleichmässig punktirt-gestreift, Intervalle etwas gewölbt, die Streifen nicht besonders scharf oder tief und ihre Punktreihe dicht, ziemlich fein. Die vier Vorderschenkel sind einfach, die Hinterschenkel haben einen kräftigen spitzen Zahn.

Rhyparida pallidula sp. nov.

Oblongo-ovalis, pallide rufo-flava, nitida, antennis apicem versus infuscatis, prothorace sublaevi, elytris flavescentibus, subtiliter striato-punctatis, intervallis planis, femoribus dentatis. Long. 3.5 mm.

LUZON, Benguet, Baguio.

Den folgenden Arten in Körperform und Farbe zwar sehr ähnlich, aber auf den Flügeldecken feiner und flacher punktirt, ohne gewölbte Intervalle. Länglich oval, blass rötlich gelb, die Flügeldecken heller und mehr weisslich gelb, Fühler zwei Drittel so lang wie der Körper, normal gebaut, die sieben etwas stärkeren Endglieder gebräunt. Stirn ziemlich glatt, der Scheitel und das Kopfschild punktulirt. Thorax glatt, fast doppelt so breit wie lang, an den Seiten mässig gerundet und vorn zusammengedrückt-verengt. Flügeldecken in den Schultern etwas breiter wie das Halsschild, sodann ziemlich parallel, hinten verengt und mässig breit gemeinschaftlich abgerundet, fein in regelmässigen Reihen punktirt, mit ebenen Intervallen, hinter der Basis leicht quer eingedrückt. Der Zahn an den Hinterschenkeln spitz, mässig gross, an den Vorderschenkeln kleiner und stumpfer, an den Mittelschenkeln nur angedeutet.

Rhyparida diluta sp. nov.

Subovalis, rufo-testacea, antennis pedibusque flavescentibus, elytris punctato-striatis, intervallis convexiusculis, stria sexta et septima basi connexis, femoribus anterioribus vix dentatis. Long., 3 mm.

LUZON, Laguna, Mount Maquiling.

Etwas breiter gebaut und kleiner als die vorige, der Körper rötlich gelbbraun, Fühler und Beine mehr gelb, Kopf und Halsschild glatt, die Flügeldecken punktirt-gestreift, und die Intervalle leicht gewölbt, der sechste Streifen von der Basis bis zum

Ende der Schulterbeule mit dem siebenten und der zwölfte und dreizehnte von ein Viertel bis hinter drei Viertel der Länge verbunden. Der Zahn der Hinterschenkel ist sehr klein, der an den vier vorderen Schenkeln kaum bemerkbar.

Rhyparida philippina sp. nov.

Subovalis, lutea, nitida, capite prothoraceque rufescentibus, hoc sublaevi interdum fusco-bimaculato, elytris apicem versus parum angustatis, infra basin impressis, sat profunde punctato-striatis, vitta suturali et marginali, puncto humerali, vittula brevi subbasali vittaque submedia elytrorum utrinque abbreviata nigris, antennis et pedibus interdum plus minusve infuscatis, femoribus dentatis. Long., 3 ad 4 mm.

LUZON, Laguna, Los Baños, Mount Maquiling, Mount Banahao: Benguet, Baguio: Tayabas, Malinao. MINDANAO, Iligan (*4752, 4754, 4756, 6134*).

Ab. diffinis. Elytris nigris, basi extrema interdum luridis.

Ab. obscura. Prothorace, scutello elytrisque nigris.

Ab. laeta. Elytris flavescentibus, sutura infuscata.

Eine häufige, in der Färbung veränderliche Art, meist grösser wie die vorige, in den Schultern stärker heraustretend und nach hinten merklich verengt, alle Schenkel gezähnt. Hell und glänzend lehmgelb, Kopf und Halsschild etwas dunkler, rotgelb, letzteres zuweilen mit zwei runden schwarzen Flecken neben einander in der Mitte, auf den Flügeldecken ein Naht- und Seitensaum, eine kleine gerundete Schultermakel nebst zwei Längsmakeln auf jeder schwarz. Der Nahtsaum reicht vorn bis in die kurze erste Punktreihe, erweitert sich dann in der Nähe des Quereindruckes bis in die zweite oder dritte Reihe, und verschmälert sich dann allmählich so dass er zuletzt nur noch die Nahtkante einnimmt, oder vor der Spitze endet. Der Seitensaum beginnt schmal in der Schulterecke, verbreitert sich etwa bis in die zehnte Punktreihe und ist in ungefähr drei Viertel der Länge abgekürzt. Die erste Längsmakel, zwischen der dritten und fünften Punktreihe, reicht von der Basis bis in den Quereindruck, die zweite beginnt an der hinteren Aussenecke der ersten, nimmt den Raum zwischen der fünften und siebenten Punktreihe ein, und endet in drei Viertel der Länge. Diese Zeichnung verbreitert sich allmählich bis die Decken schwarz sind, doch bleibt in der Regel ein feiner Basalsaum gelb (ab. *diffinis*), oder Thorax, Schildchen, und Flügeldecken sind einfarbig schwarz (ab. *obscura*) ; ebenso verschwindet die Zeichnung der Oberseite bis auf einen gebräunten Nahtsaum ganz (ab. *laeta*). In der

Stammform und den beiden ersten Abänderungen sind die Beine einfarbig lehmgelb bis mehr oder weniger angedunkelt. Stirn glatt oder nahe dem Scheitel fein punktirt, der Clypeus durch eine gebogene und punktirte Quervertiefung undeutlich geschieden. Halsschild glatt (unter starker Vergrösserung zart gewirkt und sparsam, verloschen punktulirt), nahe der Mitte am breitesten und nach vorn zusammengedrückt-verengt, die Seiten gerundet und die Borstenkegel spitz, nach aussen tretend. Flügeldecken ziemlich tief punktirt-gestreift, mit gewölbten Intervallen, die vor der Mitte etwas breiter wie dahinter sind. Der siebente und achte Streifen beginnt in gleicher Höhe hinter der glatten Schulterbeule, der neunte zweigt sich erst vor der Mitte vom achten ab. Die Mittelschenkel haben den kleinsten, die Hinterschenkel den grössten Zahn.

Rhyparida illaesa sp. nov.

Oblongo-ovalis, rufo-testacea, nitida, capite prothoraceque obsolete punctulatis, elytris fortiter punctato-striatis, punctis striae ultimae medio obsoletis, femoribus dente minutissimo armatis. Long., 6 mm.

MINDANAO, Dapitan (*4731*).

Mehr als doppelt so gross wie die vorige, glänzend rötlich gelbbraun, die Stirn im oberen Teile und das Kopfschild ziemlich dicht, aber äusserst fein und verloschen punktulirt, letzteres quer-viereckig, oben schlecht begrenzt, die Mittelrinne der Stirn flach, die Augenrinnen tief. Halsschild ähnlich wie der obere Teil der Stirn, aber weitläufiger punktulirt, nahe der Mitte am breitesten und von hier nach vorn etwas stärker wie nach hinten gerundet-verengt, mit kräftigen Borstenkegeln in den Ecken. Flügeldecken stark punktirt-gestreift, die gewölbten Intervalle glatt, der siebente Punktstreifen vorn länger wie der achte, der zwölfte im ersten und letzten Viertel frei, dazwischen mit dem letzten verbunden, welcher im mittleren Teile weitläufig und undeutlich punktirt ist. Der Schenkelzahn ist äusserst klein.

Rhyparida spissa sp. nov.

Oblongo-ovalis, lurida, capite prothoraceque obsolete punctulatis, subopacis, elytris nitidis, profunde punctato-striatis, punctis striae ultimae medio distinctis, femoribus dente minuto armatis. Long., 6 mm.

PALAWAN, Puerto Princesa.

Grösse und Körperform stimmen mit *Rhyparida illaesa* überein, der Körper ist aber bedeutend heller gefärbt, lehmgelb, Kopf

und Thorax sind ziemlich matt, letzteres an den Seiten etwas stärker gerundet; die Flügeldecken sind noch tiefer gestreift und punktirt, auch die Punkte im letzten Streifen deutlich, der siebente ist vorn unbedeutend länger wie der achte, und der zwölfte trennt sich bald hinter der Mitte vom dreizehnten; der Schenkelzahn endlich ist etwas grösser.

Rhyparida hebes sp. nov.

Elliptica, sat convexa, pallide rufo-flava, clypeo fronte separato, oculis magnis, parum convexis, prothorace punctulato, elytris subopacis pone basin haud impressis, subtiliter striatis, striis parum dense punctulatis, femoribus posticis dente minutissimo armatis. Long., 5 mm.

MINDANAO, Dapitan (*4732*).

Elliptisch, an den Seiten schwach gerundet und nach vorn und hinten fast gleichmässig verengt, ziemlich gewölbt, blass rötlich gelb, Flügeldecken und Beine mehr gelblich, erstere fast matt. Kopfschild punktulirt, von der Stirn durch eine zweibogige Querlinie geschieden, die jederseits in die tiefe Augenfurche übergeht. Augen gross, aber flach, seitwärts kaum die Vorderecken des Thorax erreichend. Fühler schlank, bis zur Mitte der Flügeldecken ausgedehnt. Halsschild doppelt so breit wie lang, nach vorn gerundet-verengt, auf einem schmalen Querstreifen an der Basis glatt, davor nicht dicht punktulirt, die Pünktchen werden nach vorn und aussen allmählich feiner. Flügeldecken vorn nur so breit wie das Halsschild, in den schräg nach hinten wenig heraustretenden Schultern etwas breiter, ohne Quereindruck hinter der Basis, fein gestreift, in den Streifen nicht dicht punktulirt, mit breiten, ziemlich ebenen Intervallen. Vorder- und Mittelschenkel sind einfach, die Hinterschenkel haben einen sehr kleinen Zahn.

Rhyparida tabida sp. nov.

Oblongo-ovalis, pallide flava, nitida, antennis gracilibus apicem elytrorum attingentibus, capite et prothorace laevibus, elytris striato-punctatis, pone basin leviter impressis, punctis pone medium deficientibus, femoribus muticis. Long., 3.5 mm.

LUZON, Mount Banahao.

Länglich eiförmig, glänzend blassgelb, Fühler sehr schlank, so lang wie der Körper, nach der Spitze leicht gebräunt. Kopf glatt, Stirn im unteren Teile von den Augen eingeengt, mit einer angedeuteten Mittelrinne die auf dem gewölbten oberen Teile in eine erhöhte Linie übergeht. Kopfschild dreieckig länger wie breit, von der Stirn schlecht geschieden. Thorax

kaum um die Hälfte breiter wie lang, querüber gewölbt, bald hinter der mitte am breitesten, nach vorn mehr wie nach hinten verengt, die Seiten schwach gerundet, die Scheibe völlig glatt. Flügeldecken an der Basis fast gradlinig heraustretend und in den rechtwinkeligen Schultern breiter wie das Halsschild, mit einem schwachen Eindrucke hinter der angedeuteten Basalbeule, vor der Mitte in Reihen punktirt, die dahinter erlöschen.

Rhyparida pictipes sp. nov.

Subovalis, convexiuscula, subtus nigra, antennis, palpis pedibusque flavis, genubus nigris, supra lurida, nitida, prothorace fusco-signato, crebre, latera versus fortius punctato, lateribus angulatis, elytris striato-punctatis, pone basin leviter transversim impressis, sutura, vitta laterali punctisqui duobus (1, 1) fuscis, femoribus dente minutissimo armatis. Long., 3 ad 3.8 mm.

MINDANAO, Butuan (*4755*).

Ab. *a*. Prothorace, scutello elytrisque nigris (*4753*).

An der Färbung der Beine und der Bildung der Thoraxseiten gut zu erkennen. Länglich eiförmig, mässig gewölbt, unten schwarz, Fühler, Taster, und Beine gelb, Hüften angedunkelt, die äusserste Basis und die Spitze der Schenkel nebst der Schienenbasis ziemlich breit schwarz, Oberseite schmutzig gelb, glänzend, ein Mittelfleck und die Seiten des Halsschildes (später zu einer Querbinde vereint, die einen in der Mitte erweiterten Saum an der Basis und Spitze frei lässt), das Schildchen, die Naht und eine auf der Schulter erweiterte, hinten verengte Seitenbinde nebst zwei kleinen Flecken zwischen der fünften und sechsten Punktreihe jeder Flügeldecke schwärzlich, der erste hinter dem Quereindrucke, der andere hinter der Mitte. Diese Zeichnung dehnt sich zuletzt völlig über den Thorax, das Schildchen, und die Flügeldecken aus (ab. *a*). Die Fühler überragen wenig die Mitte der Flügeldecken, Kopfschild und Stirn sind nicht getrennt, sparsam punktulirt. Thorax hinter der Mitte in einer stumpfwinkeligen Ecke am breitesten, von hier nach hinten gradlinig, nach vorn stärker und gerundet-verengt, auf einem Längsstreifen in der Mitte ziemlich dicht und fein, nach den Seiten dichter und viel stärker etwas runzelig punktirt. Flügeldecken an der Basis wenig schräg heraustretend und in den stumpfwinkeligen Schultern viel breiter wie das Halsschild, auf der Scheibe in regelmässigen Reihen punktirt, die hinten schwächer werden. Die Schulterbeule ist klein, schmal, denn sie wird nicht von der sechsten Punktreihe abgesetzt, wie bei den meisten übrigen Arten, sondern von der siebenten, welche ziemlich bis zur Basis reicht.

Rhyparida signifera sp. nov.

Subelliptica, testaceo-flava, nitida, antennis articulis octo ultimis, sutura elytrorum pectoreque infuscatis, linea media abbreviata prothoracis, punctis tribus in elytro singulo (1, 1, 1) apiceque femorum posticorum nigris. Prothorace transverso lateribus rotundato, subtiliter-, juxta marginem lateralem fortius punctato, elytris (pone basin transversim impressis) striato-punctatis, punctis pone medium subtilioribus, femoribus dento minuto armatis. Long., 3.3 mm.

LEYTE, Tacloban.

Etwas breiter gebaut wie die vorige, die Fuhler grösstenteils dunkel, das Halsschild auf der Scheibe feiner und nur nahe an den gleichmässig gerundeten und deutlich gerandeten Seiten stark punktirt. Annähernd elliptisch, mässig gewölbt, hell bräunlich gelb, das Halsschild mit rötlicher Beimischung, die acht letzten Fühlerglieder, die Naht der Flügeldecken, und die Brust angedunkelt, eine Mittellinie des Thorax (vorn weiter abgekürzt als hinten), die Spitze der Hinterschenkel und drei kleine Flecke jeder Flügeldecke schwarz. Der erste Fleck ist lang dreieckig und liegt auf dem inneren Teile des Schulterhöckers; der zweite, hinter dem Quereindrucke zwischen der fünften und sechsten Punktreihe, und der dritte, hinter der Mitte zwischen der vierten und sechsten Punktreihe, sind gerundet. Die Fühler reichen bis hinter die Mitte der Flügeldecken, ihre sechs letzten Glieder sind etwas verbreitert. Kopf mässig dicht punktulirt, Stirn vom Kopfschilde durch einen schwachen Eindruck undeutlich geschieden. Thorax ziemlich gross, etwas breiter als lang, nach hinten wenig, nach vorn mässig gerundetverengt, ziemlich dicht, fein, nahe den Seiten plötzlich stark und leicht runzelig punktirt. Flügeldecken in den stumpfwinkeligen Schultern etwas breiter wie der Thorax, sodann parallel, hinten breit gemeinschaftlich abgerundet, mässig gewölbt, hinter der Basis kräftig eingedrückt, gereiht-punktirt, die Punkte der hinteren Hälfte abgeschwächt, die zehnte, elfte und dreizehnte Reihe stehen in Streifen welche durch schmal leistenförmige intervalle getrennt werden; die siebente Reihe beginnt hinter der Basis. Das Schenkelzähnchen ist deutlich, spitz.

Rhyparida praecellens sp. nov.

Subelliptica, albido-flava, nitidissima, antennis apice infuscatis, vertice macula nigra, prothorace punctulato utrinque parum dense punctato maculis quatuor transversim positis (externis interdum deficientibus) nigris, elytris ante medium striato-

punctatis, postice sublaevibus, singulo punctis quinque (2, 1, 2) limboque laterali postice abbreviato nigris, femoribus posterioribus dentatis, posticis apice nigris.

LUZON, Laguna, Mount Maquiling.

Weisslich gelb, stark glänzend, die letzten zwei oder drei Fühlerglieder angedunkelt, eine kleine Scheitelmakel, vier (seltener zwei) kleine gerundete Makeln neben einander nahe der Mitte des Thorax, fünf sehr kleine Flecke und ein Seitensaum jeder Flügeldecke sowie die Spitze der Hinterschenkel schwarz. Der Seitensaum ist gleichmässig schmal oder nahe der Schulter verbreitert, und endet in zwei Drittel der Länge. Der erste Fleck liegt auf dem äusseren Teile der Basalbeule, der zweite auf der Schulter, der dritte zwischen der fünften und sechsten Punktreihe unmittelbar hinter dem Quereindrucke, die beiden letzten befinden sich hinter der Mitte; der innere, zwischen der vierten und fünften Punktreihe, ist etwas mehr nach hinten gerückt wie der äussere zwischen den Punktreihen 5 und 6. Zuweilen vergrössern sich die beiden letzten und verbinden sich. Das Halsschild ist auf der Scheibe ziemlich dicht und sehr fein, aussen weitläufig und ziemlich grob punktirt, quer, an den Seiten gerundet, mit der grössten Breite hinter der Mitte. Die Flügeldecken treten an der Basis wenig schräg heraus und sind in den stumpfwinkeligen Schultern etwas breiter wie das Halsschild, hinter der Mitte fast glatt, davor gereiht-punktirt, die Punkte in und neben dem Quereindrucke kräftig. Die Vorderschenkel haben einen kaum bemerkbaren, die Mittelschenkel einen deutlichen, die Hinterschenkel einen längeren Zahn.

Rhyparida bicostulata sp. nov.

Oblongo-ovalis, convexiuscula, lurida, nitida, prothorace crebre ruguloso-punctato, lateribus rotundatis, elytris striato-punctatis unicostulatis, femoribus dente parvo armatis. Long., 3 mm.

LUZON, Benguet, Baguio.

Ausgezeichnet durch die dichte, starke, runzelige Punktirung des Thorax, die nach aussen kräftiger wird, und die nach hinten wenig abgeschwächten Punktreihen der Flügeldecken, von denen die siebente die Schulterbeule absetzt und aussen von einem fein leistenförmigen Intervalle begleitet ist, das sich von der Schulter bis an den Abfall zur Spitze hinzieht; auch das schmale Intervall zwischen den kurzen Reihen 9 und 10 ist gewölbt.

Länglich eiförmig, blass schmutzig gelb, glänzend. Fühler schlank, bis hinter die Mitte der Flügeldecken reichend, die

sechs letzten Glieder etwas verdickt. Kopfschild ziemlich sparsam, aber deutlich punktirt, mit der glatten Stirn völlig verbunden. Thorax kaum um die Hälfte breiter als lang, hinter der Mitte am breitesten, an den Seiten gerundet. Flügeldecken vorn schräg heraustretend und in den stumpfwinkeligen Schultern breiter wie das Halsschild, dahinter ziemlich parallel, aber dicht hinter der Schulter leicht eingeschnürt, hinten breit gemeinschaftlich abgerundet, gereiht-punktirt, die Punkte in den Reihen, selbst die nahe dem Quereindrucke, etwas kleiner und flacher als die auf dem Thorax. Das Schenkelzähnchen der Hinterbeine ist etwas grösser wie das der vorderen.

Rhyparida procerula sp. nov.

Sat elongata, convexiuscula, pallide flava, nitida, prothorace minus dense inaequaliter, medio subtilissime, latera versus fortius punctato, lateribus parum rotundato subparallelo, elytris subtiliter striato-punctatis, seriebus 9 ª et 10 ma serium unicam irregularem formantibus, femoribus posticis obsolete dentatis. Long., 2.3 ad 3 mm.

LUZON, Laguna, Mount Maquiling: Tayabas, Malinao (*4745, 4746, 2890*).

Eine kleine, schlank gebaute, hell gelbe, und oben stark glänzende Art, kenntlich durch die ungleichmässige, nicht dichte, innen feine, aussen stärkere Punktirung des Thorax, die in ziemlich feinen, nach hinten abgeschwächten Reihen punktirten Flügeldecken, auf denen die Reihen 9 und 10 zu einer etwas unregelmässigen Reihe verbunden sind, endlich durch die einfachen vorderen Schenkel, da nur die Hinterschenkel ein leicht zu übersehendes Zähnchen besitzen.

Rhyparida helvola sp. nov.

Oblongo-ovalis, sat convexa, helvola, nitidissima, antennis pedibusque flavis, prothorace medio sublaevi latera parum rotundata versus crebre ruguloso-punctato, elytris prothorace multo latioribus, subtiliter striato-punctatis, punctis pone medium evanescentibus, seriebus 9 ª et 10 ma distinctis, femoribus posticis dente minuto armatis. Long., 2.3 ad 3 mm.

LUZON, Laguna, Mount Maquiling (*2310*).

Von der Grösse der vorigen Art, aber in den Flügeldecken breiter gebaut, ganz verschieden skulptirt. Länglich eiförmig, ziemlich gewölbt, gelblich rotbraun, stark glänzend, Fühler und Beine gelb, erstere schlank, bis hinter die Mitte der Flügeldecken reichend. Kopf fast glatt, die Stirn schwach gewölbt und vom

quer viereckigen Kopfschilde durch einen sanften Eindruck getrennt. Thorax klein, etwa halb so breit wie die Flügeldecken, an den Seiten wenig gerundet, auf einem Streifen, der etwa das mittlere Drittel einnimmt, glatt, nur nahe dem Vorderrande zart punktulirt, an den Seiten dicht runzelig punktirt. Die Flügeldecken treten an der Basis fast gradlining heraus, haben dahinter einen kräftigen Quereindruck und sind in der vorderen Hälfte fein und namentlich flach gereiht-punktirt, hinter der Mitte fast glatt; die kurzen Reihen 9 und 10 regelmässig. Hinterschenkel mit einem feinen Zähnchen.

Rhyparida biformis sp. nov.

Subovalis, convexa, subtus picea vel nigra, antennis infuscatis basi palpisque flavescentibus, femorum basi, tibiis apicem versus tarsisque saepe obscure ferrugineis, supra aeneo-nigra, capite apiceque elytrorum ferrugineo translucentibus, prothorace punctulato, punctis latera versus fortioribus, elytris subtiliter striato-punctatis, pone medium sublaevibus. Long., 2.5 ad 3.3 mm.

LUZON, Laguna, Los Baños, Mount Maquiling: Benguet, Baguio: Tayabas, Malinao (*686*, *2266*).

Femina: Elytris costula humerali bis interrupta.

Diese Art lässt sich an dem dunkelgrünen Metallschimmer erkennen, welcher den grössten Teil der Oberseite überzieht. Etwas länglich-oval, gewölbt, pechschwarz oder schwarz, Fühler angedunkelt, an der Basis mehr oder weniger weit nebst den Tastern gelblich, Schenkelbasis, Schienenspitze, und Tarsen meist dunkel rostrot. Oberseite metallisch grünlich schwarz glänzend, der untere Teil der Stirn, der Clypeus und die Spitze der Flügeldecken, seltener auch der Vorderrand des Thorax roströtlich durchschimmernd. Stirn und Kopfschild kaum getrennt, sparsam punktulirt, Fühler etwas kürzer wie der Körper. Halsschild kaum (Männchen) oder völlig um die Halfte breiter als lang (Weibchen), mit der grössten Breite hinter der Mitte, die Seiten gerundet, die Scheibe mässig dicht in der Mitte sehr fein, nach den Seiten hin stärker punktirt. Flügeldecken an der Basis wenig schräg heraustretend und in den stumpfwinkeligen Schultern bedeutend breiter wie das Halsschild, vor der Mitte fein gereiht-punktirt, hinter derselben fast glatt. Beim Weibchen sind die Reihen 3 bis 8 sehr weitläufig punktirt und die elfte rinnenförmig vertieft und vom vorderen freien Teile der zwölften durch ein hohes, rippenartiges Intervall getrennt, welches zweimal unterbrochen ist. Der Zahn an den vier vorderen Schenkeln ist sehr klein, an den Hinterschenkeln grösser.

Rhyparida hypocrita sp. nov.

Subovalis, convexa, nigra, nitida, antennis infuscatis basi, palpis ventreque apicem versus flavis, pedibus interdum plus minusve piceo-rufis, prothorace dense latera versus fortius punctato, elytris striato-punctatis pone medium sublaevibus. Long., 2.3 ad 3 mm.

LUZON, Laguna, Mount Maquiling; Mount Banahao (*2797, 2798, 6133*).

Femina: Elytris costula humerali bis subinterrupta.

Ab. *a*. Elytris brunneo-rufis, unicoloribus vel macula fusca signatis.

Der vorigen zwar sehr ähnlich, die Oberseite aber stärker punktirt und nie mit der Spur eines metallischen Schimmers. Glänzend schwarz, Fühler angedunkelt, ihre Basis nebst den Tastern und den letzten Bauchsegmenten gelb, zuweilen sind die Beine rötlich pechbraun, die Spitze der Schenkel und die Schienenbasis schwarz, oder (ab. *a*) die Flügeldecken rotbraun, ihre Spitze gelblich, auf jeder manchmal eine grosse, wenig bemerkbare schwärzliche Makel hinter der Mitte; noch nicht ausgereifte Stücke sind hell rötlich gelbbraun, die Beine grösstenteils gelb. Kopfschild kaum von der Stirn getrennt, Fühler etwas kürzer wie der Körper. Halsschild wenig (Männchen) oder bedeutend breiter wie lang (Weibchen), mit der grössten Breite hinter der Mitte der gerundeten Seiten, mässig dicht oder dicht (in der Mitte fein, an den Seiten stärker) punktirt. Flügeldecken in den stumpfwinkeligen Schultern bedeutend breiter wie das Halsschild, gereiht-punktirt, die Punkte vor der Mitte mässig gross und tief, dahinter bedeutend abgeschwächt, nahe der Spitze wieder etwas stärker, der Abstand der Punkte vor der Mitte kleiner als ein Punkt. Das Intervall zwischen der elften und dem Basalteile der zwölften Punktreihe bildet eine feine Leiste, die bei dem Weibchen stärker und zweimal leicht unterbrochen ist.

Rhyparida polychroma sp. nov.

Breviter ovalis, convexa, pallide flavo-testacea, nitida, prothorace transverso, punctulato, lateribus rotundatis, elytris pone basin haud impressis, subtiliter striato-punctatis, interstitiis uniseriatim punctulatis.

Long., 2 ad 2.5 mm.

LUZON, Laguna, Los Baños, Mount Maquiling; Mount Banahao: Tayabas, Malinao: Benguet, Baguio (*272, 690, 2258, 2448, 2795, 2799, 2803, 4763, 6170, 6182*).

Ab. *a*. Elytris macula communi aenea.

Ab. *b*. Elytris nigro-aeneis vel nigro-coeruleis, maculis duabus flavescentibus, prima humerali, secunda apicali.

Ab. *c*. Ut in *b*, sed maculis deficientibus.

Ab. *d*. Ut in *b*, sed prothorace etiam nigro-aeneo vel coeruleo.

Ab. *e*. Ut praecedens, sed differt macula apicali nulla, macula humerali minima.

Ab. *f*. Ut in *d*, sed macula humerali nulla.

Ab. *g*. Corpore supra omnino aeneo- vel coeruleo-nigro.

Die kleinste Art, durch ihre kurz ovale Körperform, die gleichmässig gewölbte Scheibe der Flügeldecken ohne Spur eines Quereindruckes, und die variirende Zeichnung der Oberseite recht ausgezeichnet. Blass rötlich oder bräunlich gelb, glänzend, Fühler und Beine gelb, erstere sind schlank und reichen wenig über die Mitte der Flügeldecken hinaus. Kopf gross mit breiter Stirn, die weitläufig punktulirt ist und mit dem Clypeus eine Fläche bildet. Augen gross, gewölbt, leicht nach hinten vortretend. Halsschild hinter der Mitte am breitesten, nach vorn mehr als nach hinten gerundet-verengt, doppelt so breit wie lang, nicht dicht, in der Mitte sehr fein, nach aussen etwas stärker punktirt. Die Flügeldecken sind in den schräg vortretenden Schultern breiter wie das Halsschild und haben die normalen dreizehn Punktreihen, welche vor der Mitte ziemlich fein, dahinter sehr fein sind; ihre breiten Intervalle tragen eine nicht ganz regelmässige Reihe minimaler Pünktchen.

Ich bin hier von der fast einfarbig hellen Form ausgegangen, weil sie die häufigste zu sein scheint. Es zeigt sich in der Folge auf den Flügeldecken zunächst ein gemeinschaftlicher grünlich- oder bläulich-schwarzer Fleck, entweder von der Basis bis zur Mitte, nach hinten gleichmässig in eine Spitze verschmälert, oder in den mittleren beiden Vierteln der Länge, gerundet oder viereckig, verwaschen begrenzt (ab. *a*). Später sind die Flügeldecken grünlich oder bläulich schwarz, mit je zwei ziemlich grossen gelben Makeln, eine in der Schulterecke, die andere in der Spitze (ab. *b*); wenn diese erlöschen entsteht die ab. *c*; Rötlich gelb, Beine gelb, Schildchen und Flügeldecken grün bis blau. In den folgenden Abänderungen ist das Halsschild grünlich oder bläulich schwarz; die ab. *d* hat auf den Flügeldecken noch wie *b* zwei grosse gelbe Makeln, von diesen verschwindet die Spitzenmakel (ab. *e*) oder die Schultermakel (ab. *f*), endlich fehlen beide (ab. *g*). Von diesen Abänderungen tritt *a* und *f* nur selten auf.

Aus Vorstehendem ist zu ersehen dass die Gatturg *Rhyparida* auf den Philippinen reichlich vertreten ist. Bisher waren nur zwei Arten von dort bekannt: *R. costata* Jacoby, die ich für einen mit 7 Millimeter Länge etwas zu gross angegebenen *Phytorus fervidus* halte, und *R. lateralis* Baly, mir unbekannt aber wohl der *R. biformis* nahe stehend. Die Arten sind recht übereinstimmend gebaut und nicht leicht zu unterscheiden; sie haben auf den Flügeldecken dreizehn Punktreihen, von denen die erste sehr kurz und die zwölfte mit der dreizehnten auf eine weite Strecke in der Mitte vereint ist; selten sind auch die Reihen 9 und 10 zu einer verbunden.

Zur schnellen Orientirung dürfte die folgende Tabelle geeignet sein:

Tabelle der neuen Rhyparida-Arten.

1. Episternen der Vorderbrust punktirt ..... 2.
1. Episternen der Vorderbrust glatt ..... 3.
2. Die Punkte der Episternen lassen einen schmalen Streifen am Aussenrande frei, Punktreihen 9 und 10 der Flügeldecken in eine Reihe vereint. Länge, 3.5 bis 4 mm. Palawan..... **R. episternalis sp. nov.**
2. Episternen vor der Mitte glatt, dahinter punktirt. Länge, 4.3 bis 5 mm. Luzon ..... **R. aethiops sp. nov.**
3. Stirn dicht längsrunzelig punktirt, die Punktreihen 8 bis 10 der Flügeldecken in und neben dem Quereindrucke mehr oder weniger verworren ..... 4.
3. Stirn fast glatt oder nicht dicht, fein punktirt, Punktreihen 8 bis 10 der Flügeldecken regelmässig ..... 5.
4. Die untere Stirnhälfte und der Clypeus ziemlich dicht weisslich behaart, Vorderschenkel ungezähnt, Körper schwarz. Länge, 3.5 mm. Luzon. **R. melas sp. nov.**
4. Stirn und Clypeus kahl, Vorderschenkel mit einem Zähnchen, Körper schwarz. Länge, 5 mm. Luzon..... **R. antiquula sp. nov.**
5. Die vordere Tastborste des Thorax ist auf einem spitzen Kegel befestigt, der von den Vorderecken wagerecht absteht..... 6.
5. Die vordere Tastborste auf einer schwachen Verdickung des Vorderrandes eingefügt ..... 11.
6. Oberseite gesättigt metallisch grün, Beine schwarz, der verdickte Teil der Schenkel rotgelb. Länge, 4 mm. Mindanao.... **R. bakeri sp. nov.**
6. Oberseite ohne starke metallische Farben..... 7.
7. Flügeldecken gereiht-punktirt, Intervalle eben. Blass rötlich gelbbraun, Flügeldecken bräunlich gelb. Länge, 3.5 mm. Luzon. **R. pallidula sp. nov.**
7. Flügeldecken punktirt-gestreift, Intervalle mehr oder weniger gewölbt ..... 8.
8. Vorderschenkel kaum gezähnt, die sechste und siebente Punktreihe der Flügeldecken vorn verbunden. Rötlich gelbbraun. Länge, 3 mm. Luzon ..... **R. diluta sp. nov.**
8. Vorderschenkel kräftig gezähnt, Punktreihen 6 und 7 vorn parallel.... 9.

9. Dreizehnter Streifen der Flügeldecken mit einer kräftigen und ziemlich regelmässigen Punktreihe. Körper blass bräunlich gelb. Länge, 6 mm. Palawan ..... **R. spissa sp. nov.**
9. Letzter Streifen der Flügeldecken nur vorn kräftig punktirt, die Punkte dahinter undeutlich, fast erloschen..... 10.
10. Körper rotbraun. Länge, 6 mm. Mindanao..... **R. illaesa sp. nov.**
10. Lehmgelb, Halsschild rötlich, Flügeldecken mit schwarzer Längszeichnung bis schwarz, bei frischen Stücken gelb mit dunkler Naht. Länge, 3 bis 4 mm. Luzon, Mindanao..... **R. philippina sp. nov.**
11. Augen gross, aber ziemlich flach, seitlich kaum die Vorderecken des Halsschildes erreichend. Oberseite blass rötlich gelb, Flügeldecken etwas heller, matt, ohne Spur einer Basalbeule oder eines Quereindruckes. Länge, 5 mm. Mindanao..... **R. hebes sp. nov.**
11. Augen gewölbt, seitlich die Vorderecken des Halsschildes überragend, Flügeldecken glänzend, Basalbeule deutlich (ausgenommen bei *R. polychroma*) ..... 12.
12. Halsschild glatt. Blass gelb, Schenkel ungezähnt. Länge, 3.5 mm. Luzon ..... **R. tabida sp. nov.**
12. Halsschild punktirt, wenigstens die Hinterschenkel gezähnt..... 13.
13. Seiten des Thorax mit einer sehr feinen und verloschenen Randleiste, vor der Basis, an der breitesten Stelle, stumpfwinkelig, Schulterbeule durch die siebente Punktreihe abgesetzt. Oben rötlich oder schmutzig gelb, schwärzlich gefleckt, oder ganz schwarz, Beine gelb, Spitzenhälfte der Schenkel und Basalhälfte der Schienen schwarz. Länge, 3 bis 3.8 mm. Mindanao..... **R. pictipes sp. nov.**
13. Thorax deutlich gerandet, an den Seiten gerundet, nicht winkelig.... 14.
14. Thorax hell, dunkel gezeichnet..... 15.
14. Thorax einfarbig, hell oder dunkel..... 16.
15. Diese Zeichnung besteht in einem vorn weit abgekürzten schwarzen Längsstriche. Länge, 3.3 mm. Leyte..... **R. signifera sp. nov.**
15. Die Zeichnung wird durch zwei oder vier schwarze Makeln in einer Querreihe nahe der Mitte gebildet. Länge, 3.5 bis 4 mm. Luzon. **R. praecellens sp. nov.**
16. Punktstreifen der Flügeldecken kräftig, weder auf der Basalbeule noch hinten merklich abgeschwächt, der siebente Streifen setzt die Schulterbeule ab und wird aussen von einem rippenförmigen Intervalle begrenzt, welches sich vom Schulterhöcker bis weit hinter die Mitte erstreckt. Thorax grob und dicht punktirt. Länge, 3 mm. Luzon ..... **R. bicostulata sp. nov.**
16. Schulterbeule nicht rippenförmig verlängert..... 17.
17. Flügeldecken mit zwölf Punktreihen, da die normalen Reihen 9 und 10 zu einer etwas unregelmässigen Reihe vereint sind. Körper gestreckt, weisslich gelb. Länge, 2.3 bis 3 mm. Luzon. **R. procerula sp. nov.**
17. Punktreihen 9 und 10 der Flügeldecken deutlich getrennt..... 18.
18. Seiten des Thorax mässig gerundet, über denselben stärker wie auf den Flügeldecken und dicht runzelig punktirt. Oberseite stark glänzend, rotbraun. Länge, 2.3 bis 3 mm. Luzon. **R. helvola sp. nov.**
18. Seiten des Thorax stark gerundet, darüber schwächer als auf den Flügeldecken punktirt ..... 19.

19. Körper kurz oval, Flügeldecken metallisch grünlich oder bläulich schwarz, einfarbig oder mit ein bis zwei rotgelben Makeln, häufig oberseits ganz gelb, eine Basalbeule nur angedeutet. Länge, 2 bis 2.5 mm. Luzon ..... **R. polychroma sp. nov.**

19. Länglich oval, Flügeldecken mit kräftiger Schulterbeule und beim Weibchen mit einer kurzen unterbrochenen Schulterrippe zwischen der elften und zwölften Punktreihe..... 20.

20. Flügeldecken schwarz, metallisch grün schimmernd, an der Spitze bräunlich, Punkte in den Reihen verhältnismässig weitläufig gestellt. Länge, 2.5 bis 3.5 mm. Luzon..... **R. biformis sp. nov.**

20. Flügeldecken rötlich gelbbraun, rotbraun oder schwarz, ohne Metallschimmer, Punkte in den Reihen dicht gestellt, so gross wie ein Zwischenraum. Länge, 2.3 bis 3 mm. Luzon.... **R. hypocrita sp. nov.**

Genus **CONIOMMA** novum

Corpus subcylindricum, modice convexum, glabrum. Caput exsertum, oculis subconicis vix emarginatis. Antennae graciles, filiformes, corpore aequilongae. Prothorax transversim subhemisphaericus. Prosternum elongato-quadratum basi recte truncatum, episternis margine antico concavis. Pedes elongati, graciles, femoribus (praesertim anticis) medio ampliatis, basi tenuibus, muticis. Tibiae quatuor posteriores emarginatae. Unguiculi bifidi.

Mit *Rhyparida* nahe verwandt, aber habituell und in der Form der Augen, des Thorax, der Fühler, und Beine sehr verschieden. Die Augen sehen, von der Seite betrachet, konisch aus, da sie von vorn und hinten zusammengedrückt sind, sie ragen, schräg nach hinten und seitwärts gerichtet, über die Vorderecken des Halsschildes hinaus. Die Fühler sind mehr als bei der Gattung *Rhyparida* einander genähert und höher zwischen den Augen eingefügt, so lang wie der Körper, dünn, fadenförmig, nur das erste Glied dicker wie die übrigen, das dritte länger als das erste und viel länger als das zweite, aber kürzer wie das vierte Glied, dem die folgenden ähneln. Der Clypeus ist lang, nach oben verschmälert. Augenrinnen schmal, ziemlich tief. Halsschild in der Mitte am breitesten, kissenartig gewölbt, an den Seiten tief herabgezogen, gleichmässig gerundet und fein gerandet. Beine lang, mit spindelförmigen, unbewehrten Schenkeln, deren langer Basalteil auffällig verdünnt ist. Der Körper sieht annähernd cylindrisch aus, ist aber dazu nicht genug gewölbt.

Coniomma hospes sp. nov.

Flavo-rufum, nitidum, antennis (basi excepta), pedibus (femorum basi excepta) elytrisque nigris, his maculis tribus flavis

(1, 1, 1) signatis; prothorace punctulato, elytris striato-punctatis, punctis pone medium subtilioribus. Long., 3.6 ad 4 mm.

LUZON, Benguet, Baguio (*6128*).

Ab. *a*. Maculis binis anticis elytrorum connexis.

Gelblich rot, glänzend, Fühler mit Ausnahme des ersten oder der zwei ersten Glieder, die Beine (ohne Schenkelbasis) und die Flügeldecken schwarz, letztere mit je drei gelben, nicht besonders scharf hervortretenden Makeln. Von diesen nimmt die erste mehr als die äussere Hälfte der Basalbeule ein und ist gerundet; die zweite, etwas breiter wie lang, liegt bald dahinter, durch den Quereindruck getrennt, aber zuweilen mit ihr im äusseren Teile verbunden (ab. *a*); die dritte ist die kleinste, etwas länger als breit, und liegt neben und parallel der Naht vor der Spitze. Halsschild sehr fein und nicht dicht punktirt, auf der Mittellinie und am Aussenrande glatt. Flügeldecken in den Schultern fast gradlinig heraustretend und etwas breiter als der Thorax, dann parallel, im letzten Drittel gerundet-verengt, mit schmaler Spitze, auf dem Rücken in dreizehn Reihen punktirt, die in der vorderen Hälfte mässig stark und leicht vertieft, dahinter flach und abgeschwächt sind. An der Basis liegt eine Beule die hinten zu einem ziemlich tiefen Quereindrucke abfällt.

Clypeolaria cupripennis sp. nov.

Oblongo-ovata, subtus nigricans, antennis basi, femoribus (apice excepto) ventreque testaceo-rufis, capite prothoraceque viridi-aeneis, interdum cupreo-splendentibus. hoc sat crebre latera versus crebrius, fortius et ruguloso punctatis, scutello elytrisque cupreis. Long., 4 mm.

LUZON, Mount Banahao.

Den grössten Stücken von *C. thoracica* Lefèvre ähnlich, unterseits schwärzlich bis schwarz, die ersten drei oder vier Fühlerglieder, die Schenkel, und der Bauch bräunlich rot, zuweilen etwas gelblich, Kopf und Thorax metallisch grün, öfter kupferig überflogen. Schildchen und Flügeldecken rein kupferrot, selten violett überhaucht. Stirn ziemlich dicht, der Clypeus etwas stärker und dichter punktirt. Halsschild normal gebaut, ziemlich dicht punktirt, die Punkte werden nach den Seiten hin immer dichter, stärker, und runzelig. Schildchen glatt. Flügeldecken regelmässig gereiht-punktirt, die Punkte oft messingfarbig.

Clypeolaria exigua sp. nov.

Ovalis, subtus nigra, antennis, palpis pedibusque refuscentibus, supra aeneo- vel ceoruleo-nigra, nitidula, prothorace minus dense punctulato, elytris subtiliter striato-punctatis. Long., 2.8 ad 3 mm.

LUZON, Mount Banahao (*4749*).

Die bis jetzt bekannte kleinste Art. Oval, mässig gewölbt, oben sehr dunkel und nicht lebhaft metallisch grünlich schwarz oder (namentlich auf Kopf und Halsschild) bläulich schwarz, ziemlich glänzend, unten schwarz, Fühler, Taster, und Beine rötlich gelbbraun. Kopf äusserst fein punktulirt, auf der Stirn weitläufig, auf dem Clypeus dichter. Thorax stark quer, an den Seiten gerundet und nach vorn viel mehr als nach hinten verengt, über den Vorderecken bedeutend herabgebogen, die Scheibe mindestens doppelt so stark wie der Kopf wenig dicht und sehr fein punktirt. Flügeldecken fein in den normalen dreizehn Reihen punktirt, deren Punkte an der Basis und hinter der Mitte abgeschwächt sind.

Die Gattung *Clypeolaria* scheint auf die Philippinen beschränkt zu sein. Sie ist von *Rhyparida* hauptsächlich durch die Bildung des Clypeus und des Thorax verschieden. Ersterer hat am Vorderrande einen flachen bogigen Ausschnitt welcher bei dem Männchen durch eine zahnförmige, schräg nach vorn und innen gerichtete Verlängerung jederseits, beim Weibchen nur durch eine Ecke begrenzt wird. Das Halsschild ist stark quer, hinten wenig gewölbt, vorn auf jeder Seite bedeutend herabgebogen, an den Seiten gerundet, mit einem verhältnismässig breit abgesetzten Rande. Die Arten sind so zu übersehen:

Tabelle der Clypeolaria-Arten.

1. Körper einfarbig rötlich gelbbraun, ohne jeden metallischen Schimmer, Thorax in der Mitte fein, an den Seiten etwas dichter und stärker punktirt. Länge, 4 mm. Mindanao..... **C. laticollis Lefèvre.**
1. Oberseite wenigstens auf dem Halsschilde metallisch gefärbt..... 2.
2. Thorax fast gleichmässig fein punktirt..... 3.
2. Thorax an den Seiten viel dichter und mindestens doppelt so stark punktirt als in der Mitte. Kopf und Halsschild metallisch grün, Flügeldecken kupferrot. Länge, 4 mm. Luzon..... **C. cupripennis sp. nov.**
3. Länglich oval, bräunlich gelb, Kopf und Thorax rostrot, metallisch grün oder blau schimmernd, fettig glänzend, letzterer ziemlich dicht punktirt, die Punktreihen der Flügeldecken bis hinten hin fast von gleicher Stärke. Länge, 3.5 bis 4.5 mm. Luzon.... **C. thoracica Lefèvre.**

Aendert ab: Oberseite metallisch grünlich schwarz, der Kopf öfter, die Flügeldecken fast immer nahe der Basis und Spitze verloschen gelb

durchschimmernd, Unterseite zuletzt schwarz, die Beine rötlich gelbbraun oder grösstenteils schwarz..... ab. aenescens.

3. Oval, unten schwarz, Fühler, Taster, und Beine rotgelb, oben metallisch grünlich oder bläulich schwarz, Thorax wenig dicht punktirt, Punktreihen der Flügeldecken an der Basis und hinter der Mitte sehr abgeschwächt. Länge, 2.8 bis 3 mm. Luzon, Mindanao.
C. exigua sp. nov.

Chrysopida pubipennis Lefèvre.

LUZON, Laguna, Mount Maquiling (*2898*); Paete (*4742*).

Chrysopida festiva Baly.

LUZON, Bataan, Mount Limay (*4741*). NEGROS, Cuernos Mountains.

Chrysopida murina Baly.

LUZON, Benguet, Baguio (*6127*) und die ab. *curta* Lefévre. Mount Maquiling (*2897*); Mount Banahao (*2773*).

Die Gattung *Chrysopida* ist auf den Philippinen durch zehn Arten vertreten, von denen mehrere in der Zeichnung an die prächtigen bunten Rüsselkäfer derselben Inselgruppe erinnern; sie lassen sich etwa in folgender Art übersehen:

Tabelle der Chrysopida-Arten.

1. Oberseite in ausgedehntem Masse metallisch grün, goldig oder kupferrot gefärbt, die Flügeldecken in der Regel punktirt gestreift..... 2.
1. Oberseite ohne ausgesprochen metallische Färbung, matt oder wenig glänzend ..... 7.
2. Oberseite fast glatt, nur die Flügeldecken an der Basis sehr fein verworren und in der Nähe des starken Quereindruckes weitläufig in Reihen punktirt. Schwarz oder schwarz-violett, Basis und Seiten des Thorax kupferrot, zwei Makeln am Vorderrande der Flügeldecken, eine dritte im Quereindrucke, nebst einer Querbinde nahe der Mitte, welche sich als Naht- und Seitensaum bis in die Spitze fortsetzt und so eine dreieckige Figur bildet in der zwei weitere Flecke liegen, grünlich kupferrot mit goldiger Behaarung. Länge, 8 bis 9 mm. Philippinen.
C. subglabrata Jacoby.
2. Flügeldecken punktirt-gestreift, mit gewölbten bis leistenförmigen Intervallen ..... 3.
3. Flügeldecken kahl oder gleichmässig fein und kurz behaart..... 4.
3. Auf den Flügeldecken sind eine Querbinde in der Mitte und einige Intervalle dahinter dicht mit kurzen weissen Härchen bedeckt, die übrige Fläche ist kahl. Oberseite metallisch grün, die Naht der Flügeldecken und zwei Flecke hinter der Mitte jeder einzelnen (1, 1) schwarzviolett. Länge, 9 mm. Luzon..... **C. insignis Baly.**
4. Flügeldecken bräunlich rot, eine Schultermakel und eine bogenförmige, nach hinten und aussen offene Binde am Hinterrande dunkel metallisch grün. Länge, 9 mm. Luzon..... **C. attelaboides Er.**
4. Flügeldecken metallisch grün oder goldig, schwarzviolett gezeichnet.... 5.

5. Diese dunkle Zeichnung besteht aus einem Nahtsaume, zwei gemeinschaftlichen Querbinden vor der Mitte (die erste nahe der Basis, aussen weit abgekürzt, die zweite ganz) und zwei Quermakeln hinter der Mitte, die erste bindenförmig, die andre dreieckig und zuweilen fehlend ..... 6.

5. Die dunkel Zeichnung wird durch einen Nahtsaum und drei breite Querbinden nahe der Basis, hinter der Mitte, und vor der Spitze gebildet. Länge, 7.5 bis 8 mm. Mindanao..... **C. semperi Lefèvre.**

6. Flügeldecken weisslich behaart, mässig grob punktirt-gestreift, Intervalle leicht gewölbt. Länge, 7 bis 8 mm. Luzon, Paete.
C. pubipennis Lefèvre.

6. Flügeldecken kahl, grob punktirt-gestreift, Intervalle rippenförmig. Länge, 8 mm. Luzon, Negros..... **C. festiva Baly.**

7. Thorax und Flügeldecken abgeflacht..... 8.

7. Thorax und Flügeldecken gewölbt ..... 9.

8. Pechschwarz, Fühlerbasis und Beine dunkel rotbraun, Oberseite dicht runzelig punktirt und dicht goldig seidenglänzend behaart. Länge, 5 mm. Bohol ..... **C. aureovillosa Lefèvre.**

8. Schwarz, Schenkel in der Mitte rotbraun, Kopf und Thorax sehr dicht runzelig punktirt, letzterer vor der Basis mit einem weiten Quereindrucke, Flügeldecken innen punktirt-gestreift, aussen grob verworren runzelig punktirt. Länge, 4 bis 6 mm. Luzon.
C. depressicollis Lefèvre.

9. Thorax höckerartig gewölbt. Flügeldecken in regelmässigen Reihen vor der Mitte stark, dahinter fein punktirt, ziemlich dicht weisslich behaart, mit zwei kahlen Querstreifen, der vordere breit, dicht hinter dem tiefen Quereindrucke, der andre schmaler, hinter der Mitte. Schwarz, wenig glänzend, die vier ersten Fühlerglieder (zuweilen rotbraun), der Raum zwischen Fühlerwurzel und Auge, der Oberrand des Scheitels, das Schildchen, und die Basalhälfte der Schenkel dunkel metallisch grün angeflogen. Länge, 8 mm. Luzon.... **C. nigrita Weise.**

9. Thorax gleichmässig gewölbt. Schwarz oder rotbraun, oben matt, nicht dicht weisslich behaart und dicht runzelig punktirt, eine sehr schmale, oft in einige Flecke aufgelöste, nach innen verengte und abgekürzte Querbinde vor der Mitte der Flügeldecken rötlich gelb; dahinter sind, namentlich nahe der Naht, einige Punktstreifen zu bemerken. Länge, 4.5 bis 6.5 mm. Luzon, Samar, Babuyanes.
C. murina Baly.

Bein Weibchen ist das Halsschild bedeutend breiter als beim Männchen, welches ausserdem schlanker gebaut ist und nach der Spitze leicht verdickte Vorderschienen und verbreiterte Vordertarsen besitzt. Wenn die Querbinde der Flügeldecken verschwindet entsteht die ab. *curta* Lefèvre; tritt zu der normalen Querbinde noch eine zweite hinter der Mitte, sowie ein rötlicher Längsstrich auf dem zweiten Intervalle vor der Spitze (am Ende oft hakenförmig nach vorn gebogen) und eine aus zwei Strichen bestehende Makel an der Basis (innen vom Schulterhöcker), so liegt die ab. *signifera* vor.

Colasposoma geminatum sp. nov.

Subtus nigrum, palpis basique antennarum rufescentibus, supra laete aeneo-viride subcupreo indutum vel viride-coeruleum, prothorace creberrime punctato minus nitido, elytris geminatim striato-punctatis. Long., 6 ad 7 mm.

LUZON, Bataan, Mount Limay.

Unterseite schwarz, die Schenkel der oberseits grünen Stücke nach der Spitze hin metallisch grün überflogen, die Taster und die ersten Fühlerglieder rotbraun, Oberseite lebhaft grün (von seitwärts betrachtet blass kupferig schimmernd) oder dunkel grünlich blau. Stirn mässig dicht, der Clypeus dichter und etwas stärker punktirt. Thorax doppelt so breit wie lang, von der Basis zur Mitte mässig verschmälert, davor viel stärker gerundet-verengt und zusammengedrückt, sehr dicht punktirt, daher weniger glänzend wie die Flügeldecken. Diese sind in fünf Doppelreihen punktirt, deren eingeschlossener schmaler Zwischenstreifen glatt ist, während von den breiten Intervallen die beiden inneren sparsam, die drei äusseren dicht verworren punktirt sind. Die Punktirung ist vor der Mitte stärker wie hinter derselben.

Colasposoma rugiceps Lefèvre.

LUZON, Laguna, Los Baños (*1590*).

Colasposoma cumingi Baly.

LUZON, Laguna, Mount Maquiling: Tayabas, Malinao (*4720*).

Colasposoma gregarium Lefèvre.

LUZON, Laguna, Los Baños, Mount Banahao. MINDANAO, Dapitan. LEYTE, Tacloban. Negros, Cuernos Mountains (*4721–4724*).

Tabelle der Colasposoma-Arten.

1. Kopf äusserst dicht runzelig punktirt, Körper braun metallisch. Länge, 4.8 bis 5.8 mm. Luzon..... C. rugiceps Lefèvre.
1. Kopf mässig dicht punktirt und höchstens neben den Augen gerunzelt ..... 2.
2. Thorax nur mässig glänzend, matter als die Flügeldecken, sehr dicht, kräftig punktirt, Flügeldecken mit fünf paarigen Punktreihen, die durch breite, verworren punktirte Intervalle getrennt werden; Oberseite grün oder blau. Länge, 6 bis 7 mm. Luzon.
C. geminatum sp. nov.
2. Thorax und Flügeldecken stark glänzend, letztere verworren punktirt.. 3.
3. Thorax nach vorn verhältnismässig wenig verengt. Oberseite lebhaft und gesättigt metallisch grün, Seiten goldig und etwas kupferglänzend. Länge, 6 bis 7 mm. Luzon, Mindoro..... C. cumingi Baly.

3. Thorax nach vorn stark verengt, Oberseite lebhaft metallisch grün, blau, kupferrot, oft das Halsschild anders wie die Flügeldecken gefärbt. Kupferige Stücke haben häufig einen grünen Naht- und Seitensaum. Länge, 4.5 bis 6.5 mm. Luzon, Mindanao, Leyte, Negros, Palawan.
C. gregarium Lefèvre.

Abirus philippinensis Baly.

LUZON, Laguna, Los Baños, Mount Maquiling, Mount Banahao: Benguet, Baguio (*2768, 6112, 6115*).

Oberseite lebhaft metallisch grün (oft goldig oder kupferig schimmernd), grünlich blau, blau bis dunkel violett, unten schwarz, mit grünem oder blauem Schimmer.

Tabelle der Abirus-Arten.

1. Halsschild fein und nicht dicht punktirt, an den Seiten kaum ausgebuchtet, Flügeldecken neben der Naht vor der Spitze mit zwei kurzen gewölbten Intervallen, von denen das äussere in einen kleinen, niedrigen Höcker endet. Länge, 7.5 bis 8 mm. Luzon, Mindanao, Palawan ..... **A. philippinensis Baly.**

1. Halsschild dicht und ziemlich stark nadelrissig punktirt, an den Seiten in der Mitte zweibuchtig, Höcker vor der Spitze der Flügeldecken auffällig hoch. Länge, 7 mm. Luzon, Mindanao.
A. tuberculipennis Lefèvre.

Pachnephorus bretinghami Baly.

PALAWAN, Puerto Princesa. LUZON, Laguna. Los Baños, Mount Maquiling. MINDANAO, Butuan (*6143*).

Von Indien bis China und von Sumatra bis auf die Philippinen verbreitet.

Phytorus tibiellus sp. nov.

Ovalis, convexus, flavo-testaceus, nitidus, antennis apice plus minusve infuscatis, femorum apice, tibiis tarsisque nigris; prothorace subtiliter punctato antice et latera versus sublaevi, elytris punctato-striatis, intervallis subconvexis. Long., 4 ad 5 mm.

LUZON, Laguna, Mount Maquiling; Mount Banahao (*2775*).

Dem *P. nigripes* ähnlich, etwas breiter gebaut, heller gefärbt, und oberseits stärker punktirt, die Schenkel mit Ausnahme des verengten Spitzenteiles rotgelb. Oval, gewölbt, glänzend hell rötlich gelbbraun, Fühler gelblich, nach der Spitze hin gebräunt, Mandibeln schwarz. Thorax quer, von der Basis bis zur Mitte wenig, sodann viel stärker gerundet-verengt, mit weit herabgezogenen Vorderecken, auf der Scheibe zart und verloschen gewirkt und weitläufig sehr flach punktirt, am Vorder- und Seitenrande ziemlich glatt. Flügeldecken punktirt-gestreift, die Intervalle breit, äusserst fein punktulirt, die inneren eben, die äusseren wenig gewölbt. Fortsatz am Vorderrande des Pro-

sternums lang, gerundet-abgestuzt. Hinterschenkel mit einem spitzen Zähnchen.

Phytorus fervidus Lefèvre

PALAWAN, Puerto Princesa. LUZON, Laguna, Mount Maquiling. MINDANAO, Dapitan (*4728, 4730*).

Phytorus lineolatus Weise.

LUZON, Laguna, Los Baños, Mount Maquiling: Benguet, Baguio (*1593, 1839, 6126*).

Phytorus cyclopterus Lefèvre.

PALAWAN, Puerto Princesa (*4791* Männchen, *4733* Weibchen).

Phytorus nigripes Lefèvre.

LUZON, Mount Banahao (*2776*).

Die Gattung Phytorus besteht aus drei ganz verschiedenen Teilen. Bei dem ersten, zu welchen *P. pallidus, fervidus,* und vielleicht auch *assimilis* und (?) *Rhyparida costata* Jacoby gehören, ist der Vorderrand der prosternalen Episternen gradlinig und vom niedrigen Vorderrande des Prosternums nur durch eine leichte Vertiefung (der Andeutung einer Fühlerrinne) geschieden; der ganze Rand verläuft also in einer Flucht ähnlich wie bei *Rhyparida.* Hiervon unterscheidet sich der zweite Teil (mit *P. nigripes, tibiellus,* und *lineolatus*) im Wesentlichen nur dadurch, dass der Vorderrand des Prosternums zur Aufnahme des Mundes vorgezogen ist. Im dritten Teile endlich, *Phytorus* i. sp., ist der Vorderrand der genannten Episternen schwach convex und durch eine schmale, tiefe Fühlerrinne vom Prosternum getrennt, auch die Flügeldecken einiger Arten sind beim Männchen (*cyclopterus, dilatatus*) oder in beiden Geschlechtern (*latus*) in ein Seitendach erweitert, und der Verlauf der Punktreihen 9 und 10 von dem der beiden ersten Teile recht verschieden. Hiernach lassen sich die Arten der Philippinen folgendermassen übersehen:

Tabelle der Phytorus-Arten.

1. Vorderrand der prosternalen Episternen gradlinig..... 2.
1. Vorderrand der prosternalen Episternen schwach convex..... 4.
2. Vorderrand des Prosternums niedrig, in einer Flucht mit den Episternen verlaufend; Oberseite metallisch dunkel broncefarben, grün, blau, bis kupferig-violett. Länge, 5 bis 6.5 mm. Palawan, Luzon, Mindanao.
P. fervidus Lefèvre.
2. Vorderrand des Prosternums zur Aufnahme des Mundes vorgezogen. Körper rötlich gelb oder rotbraun..... 3.
3. Körper einfarbig, höchstens die Streifen der Flügeldecken angedunkelt. Luzon..... **P. lineolatus** Weise.

3. Schenkelspitze, Schienen, und Tarsen schwarz. Länge, 4 bis 5 mm. Luzon ..... **P. tibiellus sp. nov.**
4. Flügeldecken normal gewölbt, vor der Mitte am höchsten und nach hinten in gleichmässigem Bogen abfallend..... 5.
4. Flügeldecken in der Mitte buckelig gewölbt, nach hinten allmählich abfallend, tief punktirt-gestreift, Intervalle gewölbt. Gesättigt rotbraun, zuweilen metallisch grün angehaucht. Länge, 6 mm; Breite, 4. Luzon ..... **P. gibbosus** Lefévre.
5. Körper des Männchens breiter wie lang, der des Weibchens etwas schmaler. Flügeldecken in beiden Geschlechtern mit Seitendach, dieses mit der Scheibe fast in einer Flucht abfallend und beim Weibchen kaum, beim Männchen ziemlich so breit wie die Scheibe, die zwölfte Punktreihe ganz. Länge, 6 mm; Breite, 7 (Männchen), 5.5 (Weibchen). Romblon ..... **P. latus Weise.**
5. Körper bedeutend länger wie breit, Flügeldecken höchstens beim Männchen mit ausgebreitetem Seitendache, die zwölfte Punktreihe kurz ..... 6.
6. Thorax gleichmässig, dicht, und ziemlich stark punktirt. Gelblich rot. Länge, 6 mm; Breite, 3.8. Luzon ..... **P. puncticollis** Lefèvre.
6. Thorax glatt oder nicht gleichmässig punktirt..... 7.
7. Halsschild in der Mitte deutlich punktirt, am Seiten und Vorderrande glatt. Flügeldecken mit breitem Seitendache und die dreizehnte Punktreihe kaum angedeutet (Männchen), oder ohne Seitendach, die zehnte und elfte Punktreihe vertieft und vorn durch eine kurze Rippe getrennt. Männchen: Länge, 5 mm; Breite, 3.5. Weibchen: Länge, 4 bis 4.5 mm; Breite, 2.2 bis 2.5. Palawan, Luzon, Mindoro. **P. cyclopterus** Lefèvre.
7. Thorax glatt, Flügeldecken in beiden Geschlechtern ohne Seitendach, oft metallisch grün überflogen, oder gesättigt grün. Länge, 5 mm (Männchen), 4.7 (Weibchen); Breite, 3 mm (Männchen), 2.7 (Weibchen). Luzon, Bohol..... **P. plebejus** Lefèvre.

Cleorina tibialis Lefèvre.

MINDANAO, Dapitan (*4725–4727*).

Cleorina cyrtopus Lefèvre.

LUZON, Mount Banahao: Tayabas, Malinao (*4807*).

Cleorina morosa Lefèvre.

PALAWAN, Puerto Pricesa. LUZON, Laguna, Mount Maquiling, Los Baños, Mount Banahao. MINDANAO, Dapitan (*281, 2251, 2796, 4764*).

Die Gattung *Cleorina* ist durch den schwach convexen Vorderrand der prosternalen Seitenstücke, an der Basis gezähnte Klauen, und in elf Reihen punktirte Flügeldecken ausgezeichnet; die Körperform ist breit oval oder gerundet und erinnert (auch durch die Punktirung) an *Nodostoma*, so dass gewiss mehrere Arten früher zu dieser Gattung gestellt worden sind. Sicher ist dies der Fall bei *N. cyrtopus* Lefèvre; höchst wahrscheinlich

auch bei *N. tibiale* und *N. imperiale,* vielleicht auch bei *N. anthracinum* und *N. nigritum* Baly.

Tabelle der Cleorina-Arten.

1. Punkte in den Reihen der Flügeldecken nicht genau hinter einander gestellt, die Reihen daher nicht ganz gradlinig, zwischen der siebenten und neunten Teile, von eingeschobenen Reihen, keine deutlich abgesetzte Basalbeule. Oben lebhalft metallisch grün, dunkelblau bis schwarz, unten schwarz, mit metallisch grünem Anfluge, Tarsen und Oberlippe rötlich gelbbraun, ebenso die Taster und die ersten vier oder fünf Fühlerglieder. Stirn mässig dicht, Thorax sehr dicht punktirt, letzteres an den Seiten runzelig. Flügeldecken für die Gattung ziemlich stark punktirt, die inneren Reihen etwas schwächer wie die äusseren. Länge, 3 bis 3.5 mm. Mindanao, Bohol.
C. tibialis Lefèvre.

1. Punkte in den Reihen (soweit diese vorhanden) gradlinig hinter einander gestellt, Basalbeule deutlich..... 2.
2. Thorax und Hinterbrust glatt, Punktreihen der Flügeldecken kurz, nur in und neben dem Quereindrucke deutlich..... 3.
2. Thorax in der Mitte mässig dicht und einfach, nach den Seiten hin sehr dicht und längsrunzelig-punktirt..... 4.
3. Oval, rötlich kastanienbraun, Fühler rotgelb, Glied 5 bis 9 schwärzlich, 10 und 11 gelb. Länge, 3 mm. Luzon (mir unbekannt).
C. castanea Lefèvre.
3. Breit oval, gelblich rot, Fühlerglieder 5 bis 9 schwärzlich, Flügeldecken mit Ausnahme der Spitze metallisch blau, bläulich grün oder violett, Vorderschienen an der Spitze gebogen und erweitert, Vordertarsen schwarz. Länge, 2.5 bis 3 mm. Luzon..... **C. cyrtopus Lefèvre.**
4. Punktreihen der Flügeldecken nur nahe dem Quereindrucke deutlich, an der Basis und hinter der Mitte erloschen, Metasternum glatt, mit wenigen Härchen versehen, unten schwarz, die ersten vier oder fünf Fühlerglieder und das dritte Tarsenglied rötlich, Oberseite schwarzblau. Länge, 2.6 mm. Luzon..... **C. philippinensis Jacoby.**
4. Punktreihen der Flügeldecken hinten zwar abgeschwächt, aber deutlich. Metasternum dicht stark punktirt; schwarz, oberseits metallisch dunkel violett, blau oder grün, die ersten vier oder fünf Fühlerglieder rotgelb, Taster und zuweilen auch die Tarsen rostrot. Länge, 2.4 bis 3 mm. Palawan, Luzon, Mindanao..... **C. morosa Lefèvre.**[4]

Stethotes ferruginea sp. nov.

Oblongo-ovalis, convexiuscula, ferruginea, sat nitida, prothorace saepe infuscata, crebre subtiliter punctato, elytris punctato striatis intervallis convexis. Long., 5 ad 6 mm.

PALAWAN, Puerto Princesa (*4735, 4736*).

Lang oval, ziemlich gewölbt, dunkel rostrot. Fühler und Beine heller, das Halsschild meist angedunkelt. Stirn zwischen den Augen schmal, verloschen punktulirt, unten gradlinig zu dem grossen, stärker punktirten, viereckigen Kopfschilde abfal-

[4] *C. philippinensis* Weise, Philip. Journ. Sci. § D 5 (1910) 223.

lend, mit schmalen Augenrinnen und einem Mittelgrübchen. Fühler schlank, halb so lang wie der Körper, die sieben letzten Glieder etwas erweitert. Thorax doppelt so breit wie lang, in der Mitte am breitesten, mit gerundeten Seiten nach hinten nicht ganz so stark wie nach vorn verengt, die hintere Borstenpore auf einem nach aussen vortretenden kleinen Kegel, die vordere unter den Vorderecken am Beginn der Episternalkante eingestochen. Die Scheibe ist schwach gewölbt, über den Vorderecken etwas zusammengedrückt, dicht und fein punktirt, in der Nähe des Vorderrandes fast glatt. Flügeldecken in den Schultern wenig breiter wie das Halsschild, bis zur Mitte fast parallel, dann gerundet-verengt, auf dem Rücken wenig gewölbt, mit zwölf Punktstreifen, deren Intervalle glatt, leicht gewölbt sind. Der zweite Streifen ist kurz, der neunte unregelmässig, vorn und hinten weit abgekürzt, der elfte besteht aus einem kurzen vorderen und einem längeren Teile hinter der Mitte. Der Zahn an den Vorder- und Hinterschenkeln ist ziemlich lang und spitz, an den Mittelschenkeln kleiner.

Stethotes aedilis sp. nov.

Oblongo-ovalis, convexa, nigra vel piceo-nigra, nitida, antennis, interdum etiam tarsis testaceis, scutello, elytris ventreque rufis. Fronte rugoso-punctata, prothorace subconico, minus dense subtiliter punctato, elytris striato-punctatis, seriebus pone medium obsoletis, femoribus posticis dente minuto armatis. Long., 5 ad 6 mm.

LUZON, Laguna, Los Baños: Tayabas, Malinao (*4737*).

Länglich oval, gewölbt, schwarz oder pechschwarz, die Fühler und zuweilen auch die Tarsen hell rötlich gelbbraun; Schildchen, Flügeldecken, und Bauch gesättigt bräunlich rot, stark glänzend. Stirn ziemlich breit und nebst dem Kopfschilde dicht runzelig punktirt, die Augenrinnen schmal, die Querfurche zwischen Stirn und Clypeus bald seicht, bald ziemlich tief. Fühler etwas länger als der halbe Körper, Glied 1 keulenförmig, 2 kaum dünner, kurz, 3 sehr schlank, so lang wie Glied 1 und mehr als doppelt so lang wie 2, 4 und die folgenden kürzer, vom fünften ab verbreitert. Halsschild etwas breiter wie lang, hinten wenig, vor der Mitte etwas stärker verengt, leicht konisch, die Seiten schwach gerundet, die Scheibe querüber gewölbt, ungleichmässig wenig dicht, ziemlich fein punktirt, nach dem Vorderrande zu feiner. Flügeldecken in den Schultern gerade heraustretend und bedeutend breiter wie das Halsschild, hinter der Basis eingedrückt, mit kräftiger Basalbeule, jede in

dreizehn Reihen punktirt, deren Punkte nur hinter der Basalbeule bis zur Mitte deutlich, dahinter mehr verloschen sind. Schenkel einfach, nur die Hinterschenkel haben ein sehr kleines, stumpfes Zähnchen.

Die einfachen vier Vorderschenkel entfernen nur scheinbar diese Art von der Gattung *Stethorus*, die bis jetzt aus der malayish-papuanischen Region von Java bis Neu Guinea nachgewiesen ist. Die beiden Philippinen-Arten lassen sich in folgender Art schnell trennen:

Tabelle der neuen Stethotes-Arten.

1. Thorax stark quer, wenig schmaler wie die Flügeldecken, an den Seiten breit gerundet, Flügeldecken mit zwölf Punktstreifen und gewölbten Intervallen, alle Schenkel gezähnt. Länge, 5 bis 6 mm. Palawan. **S. ferruginea sp. nov.**

1. Thorax annähernd konisch, viel schmaler als die Flugeldecken, diese mit dreizehn, vorn und hinten fast erlöschenden Punktreihen und ebenen Zwischenstreifen, nur die Hinterschenkel sehr kurz gezähnt. Länge, 5 bis 6 mm. Luzon..... **S. aedilis sp. nov.**

Corynodes bakeri sp. nov.

Sat elongatus, viridis aurichalceo micans vel viridi-coeruleus, nitidus, antennarum clava chalybaea, prothorace subremote parum profunde punctato, elytris subtiliter subseriatum punctatis, infra basin profunde transversim impressis. Long., 6 ad 8 mm.

LUZON, Laguna, Mount Maquiling; Mount Banahao (*2767, 6113, 6114*).

Mit *C. suaveolus* von gleicher Grösse und dessen oben fein punktirter Form sehr ähnlich, aber nach hinten zu etwas breiter gebaut und durch die hinten und vom Schulterhöcker tief abgesetzte hohe Basalbeule der Flügeldecken auf den ersten Blick zu unterscheiden.

Die Farbe bewegt sich zwischen lebhaft metallisch grün, zuweilen mit Messingschimmer (der Bauch meist bläulich) bis grünlich blau, stark glänzend, die Fühlerkeule stahlblau, Kopf und Thorax selten rein blau, die Fühlerglieder 2 bis 4 unten und an der Spitze rötlich. Clypeus quer, nach oben verengt, unten äusserst dicht, fein, oben weitläufiger und stärker, die Stirn zerstreut-punktirt, beide durch eine bogenförmige Querfurche geschieden, in die eine nach unten verbreiterte und vertiefte Mittelrinne der Stirn mündet. Thorax um die Hälfte breiter als lang, vor der Mitte zusammengedrückt und stark gerundet-verengt, auf der Scheibe weitläufig und flach punktirt. Flügeldecken wenig stärker aber tiefer in Doppelreihen punktirt,

die auf dem Abfalle zur Spitze einfach, aber unregelmässig werden.

Corynodes superbus sp. nov.

Elongatus, subcylindricus, obscure coeruleus parce viridimicans, capite prothoraceque crebre punctatis chalybaeis, elytris auro-cupreis geminatim striato-punctatis. Long., 8 mm.

LUZON, Benguet, Baguio (*6120*).

Etwas schlanker gebaut wie *C. suaveolus*, durch dicht punktirten Kopf und Thorax sehr ausgezeichnet. Dunkel blau, teilweise metallisch grünlich schimmernd, Schildchen grün, Kopf und Halsschild stahlblau, Flügeldecken goldig Kupferrot, glänzend. Clypeus äusserst dicht und ziemlich fein runzelig punktirt und von der weniger dicht, doch stärker punktirten Stirn durch eine Querfurche geschieden, mit welcher die nach unten verbreiterte Mittelrinne der Stirn verbunden ist. Halsschild so lang als breit, vor der Mitte gerundet-verengt und zusammengedrückt, dicht und kräftig punktirt, nur ein kleiner Raum in den Vorderecken und an der Basis sparsamer punktirt. Flügeldecken etwas breiter wie das Halsschild, dicht in Doppelreihen punktirt, mit einem leichten Quereindrucke hinter der schwachen Basalbeule, die nur vorn deutlich vom Schulterhöcker getrennt wird.

Corynodes indigaceus Chevr.

LUZON, Laguna, Los Baños, Mount Maquiling (*277, 643, 1838*).

Corynodes costatus Baly.

LUZON, Mount Banahao (*2769, 2770*).

Corynodes longicornis Baly.

LUZON, Tayabas, Malinao, (*2771*).

Corynodes congener Baly.

LUZON, Laguna, Los Baños, Mount Maquiling (*1454* Weibchen, *1455* Männchen).

Corynodes suaveolus Marshall.

LUZON, Laguna, Los Baños. MINDANAO, Iligan, Butuan, Dapitan, Cagayan (*1452, 4719, 6116–6118*).

Tabelle der Corynodes-Arten.

1. Fühler stark, ihre fünf Endglieder kaum erweitert. Länge, 8 mm. Philippinen..... **C. simplicicornis Lefèvre.**
1. Fühler mit fünf stark verbreiterten Endgliedern..... 2.

2. Der Innenrand der Augenrinnen bildet eine scharfe Kante, die ununterbrochen nach unten bis zur Fühlerwurzel läuft. Länge, 9.5 bis 13 mm. Luzon ..... **C. indigaceus** Chevr.
2. Innenrand der Augenrinnen durch die Querfurche über dem Clypeus unterbrochen ..... 3.
3. Basalbeule der Flügeldecken hoch, aussen und hinten scharf umgrenzt und vom Schulterhöcker völlig geschieden..... 4.
3. Basalbeule schwach, verloschen begrenzt und hinten mit dem Schulterhöcker verbunden ..... 6.
4. Stirn, Thorax, und Flügeldecken fein und ziemlich dicht punktirt. Länge, 11 bis 12 mm. Luzon..... **C. costatus** Baly.
4. Oberseite weitläufig punktirt, namentlich auf Stirn und Thorax..... 5.
5. Halsschild so lang als breit, an den Seiten wenig gerundet, Flügeldecken kräftig in Doppelreihen punktirt. Länge, 9 bis 12 mm. Luzon. **C. longicornis** Baly.

Breiter gebaut scheint *C. cumingi* zu sein, während *C. waterhousei* durch einen Eindruck über den Seiten des Thorax abweichen dürfte.

5. Halsschild quer, an den Seiten stark gerundet, Flügeldecken fein punktirt. Länge, 6 bis 7 mm. Luzon..... **C. bakeri sp. nov.**
6. Thorax so lang als an der Basis breit, nach vorn fast gradlining verengt, annähernd konisch. Länge, 9 bis 11 mm. Luzon. **C. congener** Baly.
6. Thorax quer, an den Seiten gerundet und nach vorn mehr als nach hinten verengt ..... 7.
7. Stirn und Halsschild dicht punktirt. Länge, 7 mm. Luzon. **C. superbus** sp. nov.
7. Stirn und Halsschild weitläufig punktirt, Körper bläulich grün, blau bis violett. Länge, 5.5 bis 7 mm. Luzon, Mindanao. **C. suaveolus Marshall.**

Viel grösser (10 bis 10.5 millimeter), bläulich grün, Kopf und Thorax sehr stark glänzend feurig-kupferrot ist *C. egregius* Lefèvre von Mindanao.

Colaspoides phalerata sp. nov.

Ovalis, convexa, subtus nigra, sternis pedibusque aeneo-viridibus, antennis basi ferrugineus, supra late viridi-aenea, violaceo-micans, nitida, capite parce punctulato, prothorace minus dense punctato, elytris minus dense subseriatim punctatis. Long., 3.2 mm.

LUZON, Laguna, Mount Maquiling.

Kleiner, etwas breiter gebaut wie die sehr ähnliche europäische *Gastroidea viridula*, oval gewölbt, metallisch grün mit Messingschimmer, von der Seite betrachetet bläulich grün bis violett, stark glänzend. Fühler schwarz, die ersten vier oder fünf Glieder rostrot, das erste oben angedunkelt, die Seitenstücke der Brust nebst dem Bauche schwarz, stellenweise grünlich oder violett schimmernd, Tarsen schwarz. Kopf sparsam fein punktirt, Thorax kurz, doppelt so breit wie lang, nach vorn stark

gerundet-verengt und zusammengedrückt, nicht dicht punktirt; ähnlich sind auch die Flügeldecken, aber stärker und in unregelmässigen und weitläufigen Doppelreihen punktirt, die vor der Spitze einfach werden.

Colaspoides icterica sp. nov.

Breviter ovalis, subtus picea, antennis (apice fuscis) pedibusque testaceo-flavis, capite ferrugineo, prothorace nigro interdum subvirescente, sat dense punctulato, elytris nigro-piceis apice flavescentibus, crebre subseriatum punctatis. Long., 3.2 ad 3.5 mm.

LUZON, Laguna, Mount Maquiling (*4747*).

Ab. *a*. Testaceo-flava, capite prothoraceque magis rufescentibus.

Mit *C. fuscoaenea* von Borneo am nächsten verwandt, kleiner, heller gefärbt und die Flügeldecken gleichmässiger punktirt. Kurz oval, nur mässig gewölbt, glänzend, unten pechbraun, an einzelnen Stellen, namentlich an der Spitze des Bauches, rötlich, Fühler und Beine blass bräunlich oder rötlich gelb, die drei bis fünf Endglieder der ersteren angedunkelt. Kopf rostrot, auf dem Scheitel zuweilen grünlich angehaucht, mehr oder weniger punktulirt, am dichtesten auf dem Clypeus, ohne Augenrinnen. Thorax wie bei der vorigen gebaut, ziemlich dicht und stärker als der Kopf punktirt. Flügeldecken pechbraun, an der Spitze gelblich, in den Schultern so breit wie das Halsschild, ziemlich parallel, im letzten Drittel gerundet-verengt, dicht in nicht ganz regelmässigen Doppelreihen punktirt, von denen die drei oder vier inneren sowie die beiden äusseren vor der Spitze einfach werden. Letztere haben gewölbte Intervalle. Die Vorderschenkel sind stärker wie die übrigen, mit einem sehr kleinen spitzen Zahne.

Colaspoides nigella sp. nov.

Ovalis, convexiuscula, nigra, nitida, antennis (apice infuscatis), palpis, tibiis tarsisque flavo-testaceis, fronte sublaevi, utrinque stria oculari impressa, prothorace parum dense subtilissimeque punctato, elytris subtiliter subseriatim punctatis, femoribus inermibus. Long., 2.3 ad 3 mm.

LUZON, Benguet, Baguio (*6138*, *6139*).

Halb so gross wie die vorige, mässig gewölbt, schwarz, Taster, Fühler (mit Ausnahme der drei oder vier angedunkelten Endglieder), und Tarsen rotgelb, Kopfschild und die ganzen Schienen (Männchen) oder nur deren Spitze (Weibchen) rötlich gelbbraun bis rotbraun. Stirn kaum deutlich punktulirt, jederseits mit

einer Augenrinne, die oben abegkürzt ist. Clypeus schlecht getrennt, viereckig, nach oben verengt, mit einigen Punkten. Halsschild nach vorn bedeutend gerundet-verengt, von oben betrachtet einem Kreissegmente ähnlich, doppelt so breit wie lang, nicht dicht und äusserst zart punktulirt. Flügeldecken so breit wie die Thoraxbasis, hinten gemeinschaftlich schmal abgerundet, dicht punktirt, die erste und zweite Reihe einfach, die folgenden unregelmässig verdoppelt, so dass sie fast wie verworren erscheinen, die fünf äusseren Reihen stärker, einfach, etwas vertieft, und ihre Intervalle gewölbt. Das Männchen ist kleiner wie das Weibchen und hat merklich erweiterte Vordertarsen.

Colaspoides philippinensis Baly.

LUZON, Laguna, Mount Maquiling und Mount Banahao: Benguet, Baguio (*2772, 6123*). PALAWAN, Mindanao.

Die Arten unterscheiden sich folgendermassen:

Tabelle der Colaspoides-Arten.

1. Oberseite und Beine lebhaft metallisch grün, Schenkel einfach..... 2.
1. Oberseite und Beine ohne ausgesprochen metallische Farben..... 3.
2. Kopf sparsam und sehr fein, Thorax und Flügeldecken weitläufig punktirt mit ebenen Intervallen. Länge, 3.2 mm. Luzon.
C. phalerata sp. nov.
2. Kopf und Thorax mässig dicht und fein, die Flügeldecken ziemlich dicht stark punktirt und gerunzelt, mit einigen leicht gewölbten Längsstreifen. Länge, 4 bis 6 mm. Luzon, Palawan.
C. philippinensis Lefèvre.
3. Vorderschenkel gezähnt, Stirn ohne Augenrinnen; Pechschwarz, Thorax zuweilen grünlich überflogen, Kopf nebst den Tastern und dem grössten Teile der Fühler und die Beine rötlich gelb, die Spitze der Flügeldecken gelblich, häufig die ganze Oberseite gelbbraun. Länge, 3.2 bis 3.5 mm. Luzon..... **C. icterica sp. nov.**
3. Schenkel ungezähnt, Stirn mit Augenrinnen; schwarz, Taster, Fühler (an der Spitze schwärzlich), Schienen und Tarsen (Männchen), oder nur die Schienenspitze und Tarsen (Weibchen) rötlich gelbbraun. Länge, 2.3 bis 3 mm. Luzon..... **C. nigella sp. nov.**

NOTES ON THE FLORA OF SOUTHEASTERN CHINA

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ONE TEXT FIGURE

In continuation of my studies on the flora of southern China [1] the present contribution, like its predecessors, is based largely on Kwangtung material; I have included the descriptions of certain presumably new species from Fokien and Kwangsi Provinces. The paper is for the most part based on collections made for the Canton Christian College by Messrs. Levine, McClure, and Groff. A small but very interesting collection was received through the Canton Christian College from Prof. K. K. Ts'oong which has yielded a number of novelties, including new species in several genera not previously known to occur in China, and a representative of one family, the Dipterocarpaceae, hitherto unrecorded from China. Tung Sing, Boung Ching, near the boundary between Kwangtung and Tonkin, where many of Professor Ts'oong's specimens were collected, is apparently a very interesting region from a botanical standpoint. In addition to the species proposed as new, totaling eighteen, in as many families, several previously described forms are recorded for the first time from Kwangtung Province. Ten genera are added to the list of those known from that province.

POLYPODIACEAE

PLAGIOGYRIA Mettenius

PLAGIOGYRIA PYCNOPHYLLA (Kunze) Mett. Farngatt. Plagiog. (1858) 8.

Kwangtung Province, Loh Fau Mountain, *Levine & McClure 6861*, September, 1921. On grassy slopes, altitude about 1,000 meters. Reported from China only from Kweichau and Yunnan. India to Java, Borneo, and the Philippines.

[1] Merrill, E. D., Notes on the flora of Kwangtung Province, China, Philip. Journ. Sci. 12 (1917) Bot. 99–116; Notes on the flora of Loh Fau Mountain, Kwangtung Province, China, op. cit. 13 (1918) Bot. 123–161; Additional notes on the Kwangtung flora, op. cit. 15 (1919) 225–261; Diagnoses of Hainan plants, op. cit. 21 (1922) 337–355.

ACROPHORUS Presl

ACROPHORUS STIPELLATUS (Wall.) Moore in Gard. Chron. (1854) 135.
Davallia stipellata Wall. Cat. (1838) no. 260.

Kwangtung Province, Loh Fau Mountain, *Levine & McClure 6908, 6909*, September, 1921. In damp shaded ravines, altitude 800 meters. India through Malaysia to the Philippines and Formosa; the genus is new to China proper.

PINACEAE

FOKIENIA Henry and Thomas

FOKIENIA MACLUREI sp. nov. *Fig. 1, a.*

Species *F. hodginsii* affinis, differt squamis foliaceis breviori-bus, orbiculari-obovatis, lobis lateralibus brevissimis, obtusis vel subacutis, haud cuspidatis.

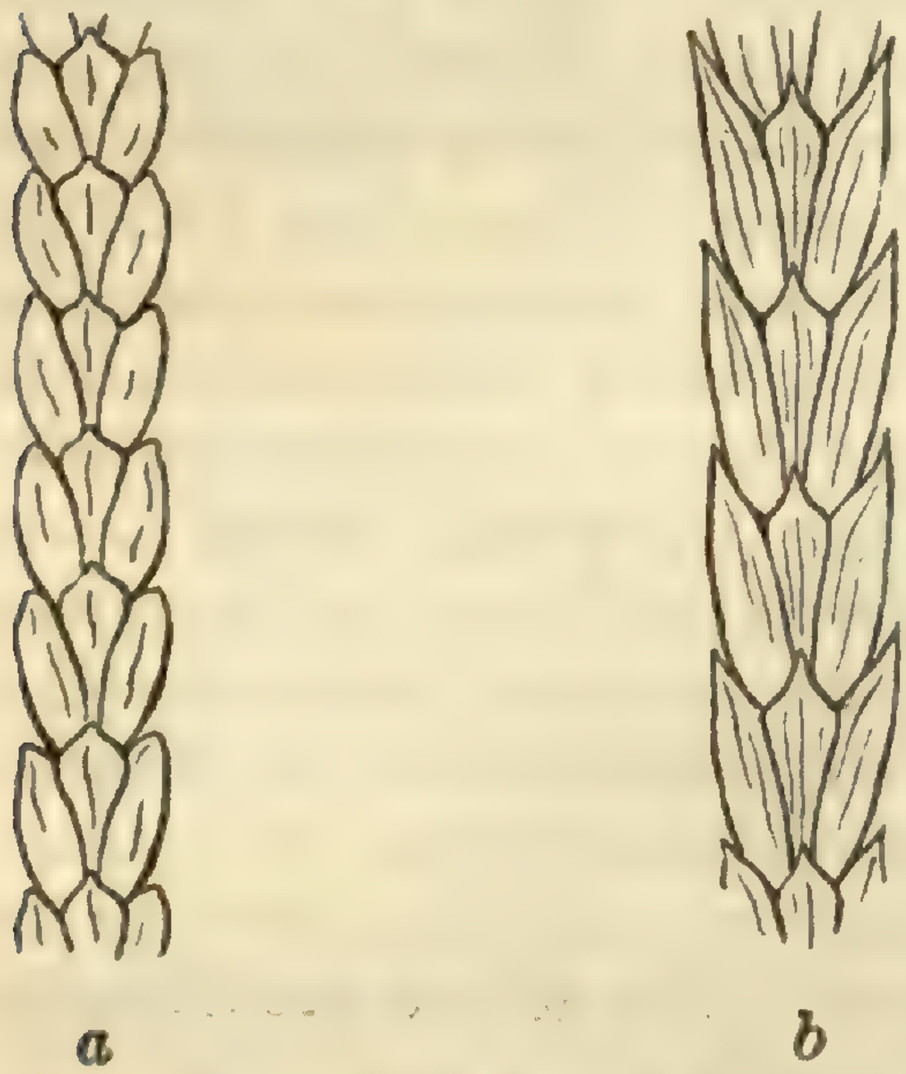

FIG. 1. Branchlets of *Fokienia* Henry and Thomas. *a*, *F. maclurei* Merr. sp. nov.; *b*, *F. hodginsii* Henry and Thomas.

A tree about 10 m high, the ultimate branches terete, brown, about 3 mm in diameter, the bark thin, the leaf-bearing branches about 10 cm long, the ultimate branchlets pinnately arranged, distichous, flattened, 2 to 4 cm long, 3 to 4 mm wide including the scalelike leaves, the dorsiventral leaves (or central lobe of the scale) broadly triangular, subacute, about 1 mm long, the lateral leaves (or flattened lateral expansions of the scales) with free, broadly ovate, obtuse to subacute tips which scarcely attain 1 mm in length, the entire scales in outline orbicular-obovate, coriaceous, 2 to 4 mm, about as wide as long, glaucous beneath. Cones globose, brown, about 12 mm in diameter, the scales about 12, coriaceous, somewhat peltate.

Fokien Province, Taai Yeung Shaan, *F. A. McClure 6572*, July 19, 1921. In moist valleys and on slopes, altitude about 600 meters, with the local name *shaan paak tsz*.

A species differing remarkably from the type and only other known species of the genus, *Fokienia hodginsii* Henry and Thomas, in its shorter, differently shaped leaflike scales, the lobes being obtuse or merely subacute, not cuspidate, the free tips of the lateral lobes not exceeding the middle lobe in length.

LILIACEAE

TRICYRTIS Wallich

TRICYRTIS MACROPODA Miq. in Versl. en Med. Kon. Akad. Wetensch. 2² (1868) 86; Baker in Journ. Linn. Soc. Bot. 17 (1879) 464.

Kwangtung Province, Loh Fau Mountain, *Levine & McClure,* September, 1921. In moist shaded ravines, altitude about 800 meters. The specimen is in fruit, but agrees closely with the descriptions of Miquel's species. The genus is new to Kwangtung Province.

URTICACEAE

POLYCHROA Loureiro

(*Pellionia* Gaudichaud)

POLYCHROA TSOONGII sp. nov.

Caulis repens, suffruticosis, 5 mm diametro, glabris; foliis longissime petiolatis, valde inaequilateralibus, chartaceis, oblongo-ellipticis, usque ad 17 cm longis, integris, acuminatis, basi valde oblique inaequilateraliter caudatis, supra glabris, olivaceis, subtus pallidioribus, ad costa nervisque leviter pilosis, utrinque cystolithis numerosis irregulariter dispositis instructis; inflorescentiis ♀ axillaribus, tenuiter pedunculatis, cymosis, subglobosis, circiter 1 cm diametro; floribus numerosis, confertis, tenuiter pedicellatis, calycis segmentis anguste oblongis, acutis vel acuminatis, 1 mm longis, haud corniculatis.

Stems creeping, suffruticose, glabrous, nearly black when dry, with numerous roots on the lower surface. Leaves chartaceous, very inequilateral, long-petioled, oblong-elliptic, entire, 11 to 17 cm long, 5 to 8 cm wide, apex acuminate, base obliquely cordate, the lobes rounded, the larger lobe 1.5 to 2.5 cm wide, the narrower one about 1 cm wide, sinus acute, the upper surface glabrous, olivaceous, the lower paler, somewhat pilose on the midrib and nerves, both surfaces with numerous irregularly disposed cystoliths; stipules lanceolate, slenderly acuminate, about 2 cm long; petioles 7 to 11 cm long, sparingly pilose. Female inflorescences axillary, solitary, subglobose, about 1 cm in diameter, their peduncles slender, about 2 cm long. Flowers numerous, crowded, their pedicels 0.5 to 2 mm long. Calyx segments 5, narrowly oblong, glabrous, 1 mm long, acute or acuminate, not at all corniculate or cucullate. Achenes elliptic, acute, somewhat compressed, about 1 mm long.

Kwangtung Province, Tung Sing, *K. K. Ts'oong 1870,* June 22, 1918.

A very characteristic species, distinguishable by its large, entire, long-petioled, very inequilateral leaves which are strongly, obliquely cordate at the base.

Polychroa Lour. is here adopted in place of *Pellionia* Gaudich., Loureiro's generic name being much the older. The type of the genus is *Polychroa repens* Lour., which is manifestly identical with the form described as *Pellionia daveauana* by N. E. Brown.[2]

PROTEACEAE

HELICIA Loureiro

HELICIA HAINANENSIS Hayata in Ic. Pl. Formos. 9 (1920) 87.

Kwangtung Province, Tung Sing, *K. K. Ts'oong 1897*, June 24, 1918, with the local name *páng sá muk*.

Previously known only from Hainan, Ts'oong's specimen matching our Hainan material, *McClure 8069, 8335, 8429*, in all respects. Another apparently undescribed species is represented by sterile material in Professor Ts'oong's collection.

LORANTHACEAE

LORANTHUS Linnaeus

LORANTHUS MACLUREI sp. nov. § *Dendrophthoë*.

Frutex parasiticus, floribus exceptis glaber, ramis teretibus, ramulis 4-angulatis; foliis oppositis, oblongis ad oblongo-ovatis, coriaceis, 2.5 ad 4.5 cm longis, olivaceis, subtus pallidioribus, obtusis vel subacutis, nervis utrinque 5 vel 6, obscuris; inflorescentiis axillaribus, solitariis, pedunculatis, 3- vel 4-floris, bracteis 3 vel 4 persistentibus coriaceis oblongo-ovatis 13 ad 18 mm longis instructis involucro triangularibus formantibus; floribus sessilibus, 5-meris, leviter pubescentibus, circiter 2.3 cm longis, corollae tubo leviter 5-costatis, segmentis 8 mm longis.

Glabrous except the slightly pubescent flowers, the branches terete, smooth, rather dark-colored when dry, the branchlets about 2 mm in diameter, somewhat 4-angled, their internodes 5 to 15 mm long. Leaves opposite, oblong to oblong-elliptic or oblong-ovate, 2.5 to 4.5 cm long, 1 to 2.5 cm wide, coriaceous, olivaceous, slightly shining, the lower surface paler, the base acute, the apex obtuse to somewhat acute; lateral nerves 5 or 6 on each side of the midrib, somewhat spreading, slender, obscure, sometimes nearly obsolete, the reticulations obsolete; petioles 2 to 5 mm long. Inflorescences axillary, solitary, peduncled, the peduncles 4 to 5 mm long, glabrous, each bearing 3 or 4

[2] Gard. Chron. 2 (1880) 262.

large, coriaceous bracts and 3 or 4 sessile flowers, the bracts forming a somewhat triangular involucre, the individual ones oblong-ovate, 13 to 18 mm long, 9 to 11 mm wide, coriaceous, foliaceous, glabrous, broadly rounded and somewhat cordate at the base, sessile and slenderly 7-nerved, the reticulations obscure, the apex acute; bracteoles none. Flowers 3 or 4, one for each bract, sessile, 5-merous, their calyces cylindric, pubescent, truncate, 3 mm long. Corolla sparingly pubescent, about 2 cm long, the tube in its lower 8 mm slender, cylindric, about 1.5 mm in diameter, then enlarged and about 4 mm in diameter, somewhat 5-ribbed but scarcely angular, the free portions of the corolla lobes about 8 mm long, their reflexed part narrowly oblong, obtuse, 3 mm in length. Free portions of the filaments about 3 mm long, the anthers oblong, 1.6 mm long.

Fukien Province, Taai Yeung Shaan, *F. A. McClure 6801*, July 21, 1921, parasitic on shrubs or trees in thickets, altitude about 600 meters.

A remarkably strong species, prominently characterized by its peduncled, 3- or 4-flowered, axillary inflorescences, the subtending large, conspicuous, foliaceous bracts forming a distinctly triangular involucre, the bracts persisting after the corolla falls.

NYCTAGINACEAE

PISONIA Linnaeus

PISONIA ACULEATA Linn. Sp. Pl. (1753) 1026; Choisy in DC. Prodr. 13[2] (1849) 440; Forbes & Hemsl. in Journ. Linn. Soc. Bot. 26 (1891) 317.

Kwangtung Province, Limchowfu, *K. K. Ts'oong 2679*, July 25, 1918.

This pantropic species has not previously been recorded from China proper, but has been recorded from Formosa and from Hainan.

LEGUMINOSAE

MIMOSA Linnaeus

MIMOSA SEPIARIA Benth. in Hook. Journ. Bot. 4 (1842) 395.

Kwangtung Province, Heung Shan, Peng Oo, *To Kang Peng 6252*, October 25, 1920, on slopes. The determination was made at Kew.

This species has previously been recorded from China, without locality, by Hemsley, but has not before been recorded from Kwangtung Province. It is a native of Brazil and is undoubtedly an introduced plant in southern China, probably coming in through Singapore where it is also established.

EUCHRESTA Bennett

5817

EUCHRESTA TRIFOLIOLATA sp. nov.

Fruticulus erectus, 0.3 m altus, vix ramosus; foliis pinnatim 3-foliolatis, 13 ad 15 cm longis, foliolis ellipticis, 6 ad 9 cm longis, 3.5 ad 5 cm latis, apice rotundatis ad breviter latissime acuminatis, in siccitate pallide olivaceis, subtus parce pubescentibus; fructibus ellipsoideis, atris, nitidis, circiter 12 mm longis.

An erect, unbranched or usually unbranched undershrub, about 0.3 m high, the stems brownish, somewhat rugose, about 3 mm in diameter, the younger parts pale greenish. Leaves 13 to 15 cm long, pinnately 3-foliolate, the rachis 4 to 5 cm long, sparingly pubescent, rather conspicuously channeled above; leaflets elliptic, 6 to 9 cm long, 3.5 to 5 cm wide, the apex rounded to very broadly and obtusely acuminate, the base usually rounded, chartaceous, the upper surface greenish-olivaceous, shining, glabrous, minutely wrinkled when dry, the lower surface sparingly pubescent with short hairs; lateral nerves indistinct, 5 or 6 on each side of the midrib, the reticulations obsolete. Infructescences about 8 cm long, terminal, the mature fruits ellipsoid, black, shining, smooth, about 12 mm long.

Kwangtung Province, Maan Chi Shan, *C. C. C. 8740*, collected by *Wai Tak*, October 10, 1921. On forested slopes.

A species at once distinguished from all other described forms of this genus by its small size and its pinnately 3-foliolate leaves.

RUTACEAE

ATALANTIA Correa

1393

ATALANTIA KWANGTUNGENSIS sp. nov.

Frutex glaber; foliis subcoriaceis, oblongo-ellipticis, 10 ad 14 cm longis, utrinque angustatis, basi acutis, apice acutis vel leviter acuminatis, nervis primariis utrinque circiter 14, perspicuis; inflorescentiis axillaribus, brevissimis, fasciculato-racemosis, paucifloris; floribus circiter 6 mm longis, 5-meris, calycis lobis orbicularis, rotundatis, petalis oblongo-ellipticis, apice rotundatis, glabris; staminibus plerumque 8, filamentis usque ad ½ connatis; ovario glabro.

A glabrous shrub, the branches terete, the branchlets somewhat compressed, unarmed. Leaves subcoriaceous, olivaceous, oblong-elliptic, 10 to 14 cm long, 4 to 6 cm wide, subequally narrowed to the acute base and to the acute or somewhat obtusely acuminate apex, the upper surface slightly shining, the lower somewhat paler; primary lateral nerves about 14 on

each side of the midrib, prominent on the lower surface, the ultimate reticulations rather close and distinct on both surfaces, the glands invisible except by transmitted light; petioles about 5 mm long. Inflorescences axillary, very short, of solitary or fasciclelike racemes, the rachis 3 mm long or less. Flowers white, about 6 mm long, their pedicels stout, 1 mm in length; bracteoles ovate, obtuse, about 1 mm long, the margins ciliate. Calyx lobes 5, orbicular, rounded, 1.5 to 2 mm wide, the margins slightly ciliate. Petals 5, 4 to 5 mm long, oblong-elliptic, rounded, glabrous. Stamens usually 8, the filaments about 3 mm long, flattened, glabrous, and united for the lower one-half; anthers 1.2 mm long. Ovary glabrous; style 1 mm long.

Kwangtung Province, Tung Sing, *K. K. Ts'oong 1936*, June, 1918, with the local name *san kat*.

This species belongs in the group with *Atalantia monophylla* Correa and *A. citroides* Pierre, and is apparently most closely allied to the former, from which it is easily distinguished by its larger leaves, which are subequally narrowed at both ends, the base being acute, the apex acute to somewhat acuminate as well as by its shorter petioles, shorter inflorescences, and 5-merous flowers.

MELIACEAE

CHISOCHETON Blume

1079

CHISOCHETON CHINENSIS sp. nov.

Arbor, partibus junioribus inflorescentiisque exceptis glabra; foliis circiter 70 cm longis, 10- vel 11-jugis, foliolis chartaceis, glabris, oblongis ad oblongo-lanceolatis, nitidis, 15 ad 20 cm longis, 4 ad 5.5 cm latis, tenuiter acuminatis, basi acutis leviter inaequilateralibus, nervis utrinque circiter 12, perspicuis; paniculis angustis, circiter 30 cm longis, ramis paucis, patulis, inferioribus 3 ad 4 cm longis; floribus 4-meris, 1.5 cm longis, calycis cupulatis, truncatis; petalis glabris, infra cum tubo stamineo villoso, 7- vel 8-laciniato, laciniae bifidae; ovario dense villoso.

A tree about 9 m high, glabrous except the younger parts and inflorescences. Leaves about 70 cm long, the rachis terete, dark when dry, sparingly pubescent with short hairs, ultimately glabrous; leaflets 10 or 11 pairs, chartaceous, oblong to oblong-lanceolate, slightly inequilateral, pale olivaceous when dry, shining, glabrous or the midrib beneath slightly pubescent, 15 to 20 cm long, 4 to 5.5 cm wide, the apex slenderly acuminate, base acute; lateral nerves about 12 on each side of the midrib, some-

what ascending, prominent; petiolules stout, 2 to 5 mm long. Panicles about 30 cm long, appressed-pubescent with short hairs, the branches few, short, scattered, spreading, the lower ones 3 to 4 cm long, the upper gradually shorter. Flowers white, racemosely arranged on the primary branches, their pedicels 3 to 5 mm long and jointed below the calyx. Mature buds about 1.5 cm long, cylindric, rather slender. Calyx glabrous or very slightly pubescent, truncate, broadly cup-shaped, 2.5 to 3 mm in diameter, about 2 mm long. Petals 4, glabrous except for the slightly puberulent apex, 2 to 2.5 mm wide above, rounded or obtuse, slightly narrowed below, united with the tube in its lower one-half. Tube cylindric, 12 mm long, the upper portion villous outside, inside sparingly villous, the apex divided into 7 or 8 oblong, obtuse lobes which are in turn often cleft or divided, sometimes forming as many as 16 linear-oblong lobes, the lobes about 2 mm in length. Anthers oblong, 1.8 mm long, the connective slightly ciliate-villous. Disk truncate, glabrous, about 0.5 mm high, 1.5 mm in diameter. Ovary densely appressed-villous; style about 11 mm long, densely appressed-pubescent.

Kwangtung Province, Tung Sing, *K. K. Ts'oong 1889*, June 24, 1918, with the local name *ho fun hi*.

This is the second species of the genus to be recorded from China and belongs in the group with *Chisocheton paniculatus* Hiern, from which it is distinguished especially by its inflorescences being only about one-half as long as the leaves and by its truncate calyces. Among the several species described by Pierre from Cochin-China from fruiting specimens, cotypes of all of which are before me, it is apparently closest to *C. thorelii*.

EUPHORBIACEAE

TRIGONOSTEMON Blume

TRIGONOSTEMON CHINENSIS sp. nov. § *Eutrigonostemon*.

Frutex dioicus, partibus junioribus plus minusve adpresse pubescentibus; foliis chartaceis, utrinque verruculoso-punctatis, oblongo-ellipticis, 6 ad 8 cm longis, basi acutis, apice tenuiter acuminatis, nervis utrinque 7 vel 8, distinctis; inflorescentiis axillaribus, solitariis, paniculatis, laxis, circiter 12 cm longis, ramis paucis, patulis; floribus paucis, flavis, petalis obovatis, 5 mm longis; antheris 3.

A shrub, the branches terete, grayish, glabrous, the branchlets reddish brown, the younger parts more or less appressed-pubescent. Leaves chartaceous, oblong-elliptic, 6 to 8 cm long, 2 to 3 cm wide, brownish olivaceous, entire or the upper part very obscurely toothed, apex slenderly acuminate, base acute, both surfaces minutely verrucose-punctate, when very young sparingly appressed-hirsute, when mature glabrous or nearly so; lateral nerves 7 or 8 on each side of the midrib, distinct; petioles about 4 mm long, when young appressed-hirsute, in age glabrous. Inflorescences solitary in the uppermost axils, paniculate, about 12 cm long, the panicles lax, the branches few, spreading, the lower ones up to 7 cm long, the upper gradually shorter, glabrous or nearly so, bracts linear, about 2 mm long. Male flowers yellow, rather few, at the ends of the ultimate branchlets, sepals oblong-obovate, 1.2 mm long, glabrous. Petals obovate, yellow, entire, 5 mm long, rounded. Anthers 3, at the top of the short column. Female flowers and fruits not known.

Kwangtung Province, Tung Sing, *K. K. Ts'oong 1875*, June 22, 1918.

This species is manifestly allied to *Trigonostemon thyrsoideum* Stapf and is the first representative of the genus to be found in Kwangtung Province and the second species to be recorded from China. It differs particularly from Stapf's species in its short petioles, its much smaller leaves, and its lax panicles.

ALCHORNEA Swartz

ALCHORNEA TILIIFOLIA (Benth.) Muell.-Arg. in Linnaea 34 (1865) 168, DC. Prodr. 15[2] (1866) 903; Pax in Engl. Pflanzenreich 63 (1914) 250.

Stipellaria tiliifolia Benth. in Hook. Lond. Journ. Bot. 6 (1854) 4.

Kwangtung Province, Yamchow, *K. K. Ts'oong 1926*, June 22, 1918, with the local name *pak mo ting*.

Himalayan region to Tenasserim, Siam, the Andaman Islands, and Tonking, hitherto recorded from China only from Yunnan.

SAPINDACEAE

NEPHELIUM Linnaeus

NEPHELIUM LAPPACEUM Linn. Mant. 2 (1771) 566.

Kwangtung Province, Poon Ye, Chim Kong, *Kwok Wa Shau 6813*, June 20, 1921. In villages (probably planted), with the local name *hung mo taan*.

A species widely cultivated in Indo-China, and Malaysia for its edible fruits; probably introduced in China, where it has not hitherto been reported.

KOELREUTERIA Laxmann

1402

KOELREUTERIA INTEGRIFOLIOLA sp. nov.

Arbor circiter 10 m alta, partibus junioribus leviter pubescentibus; foliis saltem ad 35 cm longis, bipinnatis, pinnis 3- vel 4-jugatis, circiter 20 cm longis; foliolis integris, subcoriaceis, in siccitate castaneis, subtus pallidioribus, oblongo-ovatis ad oblongo-ellipticis, 7 ad 10 cm longis, acute acuminatis, supra ad costa pubescentibus, subtus in axillis barbatis; paniculis amplis; floribus 5-meris, petalis lineari-oblongis, glabris, 9 mm longis, acutis, basi obscure auriculatis; capsulis membranaceis, glabris, oblongo-ovoideis, circiter 3 cm longis, leviter acuminatis.

A tree about 10 m high, the younger parts somewhat pubescent, ultimately nearly glabrous. Leaves at least 35 cm long, bipinnate, the primary pinnae 3 or 4 pairs, about 20 cm long, the primary and secondary rachises reddish brown, somewhat pubescent on the upper and lower surfaces, which are shallowly but widely channeled; leaflets entire, subcoriaceous, oblong-ovate to oblong-elliptic, 7 to 10 cm long, 3 to 4.5 cm wide, the base acute to rounded, slightly inequilateral, the apex rather slenderly and sharply acuminate, the upper surface castaneous when dry, glabrous except for the pubescent midrib, the lower surface paler, rather conspicuously bearded in the axils; lateral nerves about 10 on each side of the midrib. Panicles ample, apparently about as long as the leaves, the rachis and branchlets lenticellate, reddish brown, glabrous, the younger branchlets somewhat pubescent. Flowers yellow. Sepals oblong-ovate, about 2 mm long, their margins slightly ciliate. Petals 5, linear-oblong, subacute, about 9 mm long, 1.2 mm wide, glabrous, the base obscurely auriculate, the short claw somewhat pilose. Filaments 4 mm long, more or less pilose. Ovary ellipsoid. Capsules (not quite mature) inflated, oblong-ovoid, acute or slightly acuminate, glabrous, about 3 cm long and 2 cm in diameter.

Kwangtung Province, Shuikwaan, *F. A. McClure 7060*. On river banks near the monastery at low altitudes, September 8, 1921.

The second representative of the genus to be found in Kwangtung Province, rather strongly characterized by its entire leaflets.

ELAEOCARPACEAE

ELAEOCARPUS Linnaeus

209 **ELAEOCARPUS GLABRIPETALUS** sp. nov. § *Dicera.*

Arbor 7 ad 10 m alta, racemis ramulisque junioribus exceptis glabra; foliis numerosis, chartaceis, oblongo-ellipticis ad anguste oblongo-obovatis, 3 ad 7 cm longis, basi cuneatis, apice obtusis vel obtuse acuminatis, margine crenulato-denticulatis, nervis utrinque circiter 8, perspicuis; racemis paucifloris, 2 ad 3 cm longis, adpresse pubescentibus; floribus 5-meris, circiter 6 mm longis, sepalis lanceolatis ad oblongo-lanceolatis, acutis, minute pubescentibus; petalis glaberrimis, usque ad $\frac{1}{3}$ laciniatis, laciniae circiter 15; staminibus circiter 20, antheris 1.3 mm longis, cellulis subaequalibus, obtusis; ovario 3-locellato, dense pubescente.

A tree 7 to 10 m high, glabrous except the inflorescences and the very young branchlets, the branches usually reddish brown, the very young branchlets sparingly pubescent. Leaves numerous, chartaceous, oblong-elliptic to narrowly oblong-obovate, 3 to 7 cm long, 1.5 to 3 cm wide, glabrous on both surfaces, narrowed below to the cuneate base and above to the obtuse to obtusely acuminate apex, the margins distinctly crenate, the crenulae usually supplied with a glandular tip which is often inflexed; lateral nerves about 8 on each side of the midrib, somewhat spreading, anastomising, slender, distinct as are the primary reticulations; petioles about 5 mm long. Racemes axillary and from the axils of fallen leaves, rather few-flowered, 2 to 3 cm long, appressed-pubescent. Flowers white, 5-merous, their pedicels appressed-pubescent, about 4 mm long, usually 10 or fewer flowers in a raceme. Sepals lanceolate to oblong-lanceolate, acute, minutely appressed-pubescent, about 5 mm long. Petals entirely glabrous, 6 mm long, the upper one-third cut into about 15 slender lacineae. Disk pubescent, composed of 5 glands, shallowly crenulate. Stamens about 20, their filaments 0.8 mm long, the anthers oblong, scabrid, 1.3 mm long, the cells subequal, obtuse, terminated by 3 or 4 slender, short hairs. Ovary ovoid, densely pubescent, 3-celled; style 3 mm long, somewhat pubescent above. Very young fruits ellipsoid, sparingly pubescent.

Fukien Province, Taai Yeung Shaan, *F. A. McClure 6505* (type), *6467*, *7213*, July 20, 1921. In thickets and on dry slopes, altitude 600 to 700 meters, with the local name *tung to shue*.

A species in many respects resembling *Elaeocarpus lancifolius* Roxb., but differing in its smaller leaves and especially in its entirely glabrous petals.

STERCULIACEAE

COMMERSONIA Forster

COMMERSONIA BARTRAMIA (Linn.) Merr. Interpret. Herb. Amb. (1917) 362, Sp. Blancoanae (1918) 259.

Muntingia bartramia Linn. Amoen. Acad. 4 (1759) 124.
Commersonia echinata Forst. Char. Gen. (1776) 44, *t. 22*.
Commersonia platyphylla Andr. Bot. Rep. *t. 603*; DC. Prodr. 1 (1824) 486; Mast. in Hook. f. Fl. Brit. Ind. 1 (1874) 378.

Kwangtung Province, Tung Sing, *K. K. Ts'oong 1906*, June 26, 1918, with the local name *muk má*.

New to Kwangtung Province, extending from Indo-China and the Malay Peninsula through Malaysia and the Philippines to Polynesia.

DILLENIACEAE

DILLENIA Linnaeus

DILLENIA TURBINATA Finet and Gagnep. in Bull. Soc. Bot. France (1905) Mém. 4: 11, *t. 1*, and in Lecomte Fl. Gén. Indochine 1 (1907) 23, *t. 1*.

Kwangtung Province, Tung Sing, *K. K. Ts'oong 1905*, June 26, 1918.

The identification has been made from the description and figure, the specimen conforming closely to the characters given by Finet and Gagnepain, although in its venation, with about 22 pairs of primary nerves, it is closer to *D. heterosepala* Finet and Gagnepain. The floral characters, however, are those of *D. turbinata* Finet and Gagnepain. Indo-China.

Dillenia indica Linn. is the only representative of the genus hitherto recorded from China.

THEACEAE

EURYA Thunberg

EURYA STENOPHYLLA sp. nov.

Frutex erectus, glaberrimus, ramulis anguste bialatis; foliis numerosis, confertis, lanceolatis, subcoriaceis, 2.5 ad 5 cm longis, usque ad 8 mm latis, aequilateralibus, utrinque angustatis, obtuse acuminatis, basi acutis, perspicue crenato-serratis, brevissime petiolatis; floribus axillaribus, solitariis vel binis, pedicellatis, sepalis ellipticis, 2.5 mm longis, rotundatis vel retusis; fructibus oblongo-ovoideis, 5 ad 6 mm longis, acuminatis.

An entirely glabrous shrub, the branches terete, reddish brown, the branchlets narrowly winged. Leaves numerous, subcoriaceous, pale olivaceous, somewhat shining, crowded, lanceolate, 2.5 to 5 cm long, 5 to 8 mm wide, base acute, apex obtusely acuminate, margins distinctly crenate-serrate, the basal one-fourth entire; nerves 10 to 12 on each side of the midrib, slightly impressed on the upper surface, projecting on the lower surface, slender, distinct; petioles 1 mm long or less. Flowers axillary, solitary or in pairs. Sepals coriaceous, elliptic, rounded or retuse, 2.5 mm long, the pedicels in fruit 4 to 5 mm long. Fruit oblong-ovoid, 5 to 6 mm long, about 4 mm in diameter, apiculate-acuminate by the persistent style.

Kwangtung Province, Tung Sing, *K. K. Ts'oong 1940,* June 28, 1918, with the local name *lui hai ngau.*

A very characteristic species readily recognized by its being entirely glabrous and by its narrow, crowded leaves, narrowly winged branchlets, comparatively long pedicels, and unusually large, oblong-ovoid fruits.

DIPTEROCARPACEAE

SHOREA Roxburgh

SHOREA CHINENSIS sp. nov.

Arbor, petalis exceptis glabra, ramis ramulisque teretibus, tenuibus; foliis chartaceis, lanceolatis, 9 ad 13 cm longis, tenuiter acuminatis, basi acutis, nervis utrinque 7 ad 9, perspicuis; inflorescentiis axillaribus, solitariis, paucifloris, usque ad 5 cm longis, ebracteatis; sepalis orbicularibus ad oblongis, glabris, obtusis, 2.5 ad 3 mm longis, corollae lobis oblongo-ellipticis, partibus exterioribus pubescentibus, 8 mm longis; staminibus 15, glabris, antheris late ellipsoideis, connectivo glabro, 1.5 ad 1.7 mm longo, filiforme.

A tree, entirely glabrous except the exposed parts of the petals. Branches and branchlets terete, slender, dark reddish brown when dry, the ultimate branchlets about 1 mm in diameter. Leaves chartaceous, lanceolate, 9 to 13 cm long, 2 to 3.5 cm wide, base acute, apex slenderly acuminate; lateral nerves 7 to 9 on each side of the midrib, prominent on the lower surface, ascending, the primary reticulations slender, subparallel; petioles 8 to 12 mm long. Inflorescences axillary, solitary, few-flowered, up to 5 cm long, the primary branches few, 1 cm long or less, each branch bearing 3 or 4 flowers, the bracteoles none or minute and very early deciduous. Calyx tube short, the lobes unequal, orbicular to oblong, obtuse to rounded, glabrous, 2.5 to

3 mm long. Corolla lobes inequilateral, oblong-elliptic, obtuse, about 8 mm long, 3.5 mm wide, the exposed parts appressed-pubescent with short hairs. Stamens 15, in pairs, the common filament flattened, oblong-ovate, 0.6 mm long, abruptly contracted into the filiform filament proper which is 0.2 mm long or less; anthers broadly ellipsoid, 0.3 mm long, glabrous, the connective prolonged as a slender filiform glabrous appendage, 1.5 to 1.7 mm long. Ovary ovoid, glabrous; style stout, 2 mm long, apiculate. Fruit unknown.

Kwangtung Province, Tung Sing, *K. K. Ts'oong 2014*, July 27, 1918, with the local name *man ling shii*.

This is the first representative of the family to be found in China proper. It is apparently allied to *Shorea cochinchinensis* Pierre and *S. harmandii* Pierre, but is at once distinguished from both by its fewer-nerved leaves.

MYRTACEAE

EUGENIA Linnaeus

7358 **EUGENIA TSOONGII sp. nov.**

Frutex glaber, ramis teretibus, ramulis tenuibus, acute quadrangulatis; foliis numerosis, confertis, parvis, crasse coriaceis, anguste oblongis, 1.5 ad 2.5 cm longis, obtusis, basi acutis, nervis lateralibus, obscuris vel subobsoletis; inflorescentiis terminalibus, circiter 3 cm longis, anguste paniculatis; floribus omnibus pedicellatis, circiter 12 mm longis, calycis oblongis, 4 mm longis, 2.5 mm diametro, basi cuneatis, in siccitate rugosis, obscure angulatis, glaucescentibus, lobis reniformibus, rotundatis, 1 mm longis; petalis orbicularis, 2 mm diametro.

A glabrous shrub, the branches terete, grayish or reddish brown, the branchlets slender, sharply 4-angled, the internodes mostly 5 mm long or less. Leaves very numerous, crowded, narrowly oblong, thickly coriaceous, 1.5 to 2.5 cm long, 4 to 6 mm wide, the upper surface olivaceous, slightly shining, with small scattered pits, the lower surface a little paler, not punctate, the apex rounded, base acute, the midrib impressed on the upper surface, rather prominent on the lower surface; lateral nerves up to 10 on each side of the midrib, very obscure, sometimes obsolete or nearly so; petioles about 1 mm long. Inflorescences terminal and in the uppermost axils, about 3 cm long, narrowly paniculate. Flowers white, all pediceled, chiefly in threes, at the tips of the ultimate branchlets, including the stamens about 12 mm long, the pedicels 1.5 to 2 mm long. Brac-

teoles none. Calyx oblong, somewhat angled, rugose and more or less glaucous when dry, about 4 mm long, 2.5 mm in diameter, narrowed below to the cuneate base, the lobes 4 or 5, reniform, rounded, erect, persistent, about 1 mm long and 1.5 mm wide. Petals 4 or 5, orbicular, glandular-punctate, 2 mm in diameter, not united but falling as a calyptra. Stamens numerous, the filaments 4 to 7 mm long. Style about 8 mm long.

Kwangtung Province, Tung Sing, *K. K. Ts'oong 1867*, June 22, 1918, with the local name *shui so pa*.

This species manifestly belongs in the group with *Eugenia zeylanica* Wight, although radically different from that species in its very small leaves. From the description, I suspect that *Eugenia pyxophylla* Hance is allied to the present species; it differs, however, especially in its smaller flowers and turbinate buds, and in its calyx segments being triangular rather than reniform and rounded.

CORNACEAE

ALANGIUM Lamarck

ALANGIUM CHINENSE (Lour.) Rehder in Sargent Pl. Wils. 2 (1916) 552, var. **TOMENTOSUM** (Blume) comb. nov.

Diacicarpium tomentosum Blume Bijdr. (1825) 657.

Alangium begoniifolium Baill. subsp. *tomentosum* Wangerin in Engl. Pflanzenreich 41[3] (1910) 21.

Kwangtung Province, *K. K. Ts'oong 1781*, May 16, 1916, with the local name *tsat sing ngam*.

The species is widely distributed in central and southern China, but the variety has hitherto been recorded only from Java and Sumatra.

MYRSINACEAE

ARDISIA Swartz

ARDISIA REPTANS Merr. in Philip. Journ. Sci. 5 (1910) Bot. 220.

Ardisia reptans Mez in Fedde Repert. 16 (1920) 220.

Kwangtung Province, Kochow, *To Kang Peng 2665*, March 5, 1919, in woods. Hainan, Ng Chi Leng, *McClure 8481*, December 23, 1921, in forested ravines, altitude about 800 meters.

The specimens were originally identified as *Ardisia pusilla* A. DC. (*A. villosa* Mez, non Roxb.) a species known only from Japan. A critical examination, however, shows both to be identical with the Philippine *Ardisia reptans* Merr., which is allied to *A. pusilla* A. DC., and which was hitherto known only from a single collection made in Zambales Province, Luzon.

OLEACEAE

LIGUSTRUM Linnaeus

831 **LIGUSTRUM TSOONGII** sp. nov.

Arbor glabra, ramis pallidis, teretibus, ramulis junioribus puberulis, tenuibus; foliis oblongo-ovatis ad oblongo-ellipticis, coriaceis, pallidis, 4 ad 8 cm longis, obtusis ad rotundatis, saepe leviter retusis, basi acutis vel decurrento-acuminatis, nervis utrinque 8 ad 10, valde tenuibus, obscuris, reticulis subobsoletis, subtus minutissime puncticulatis; inflorescentiis axillaribus, numerosis, 7 ad 10 cm longis, laxis, multifloris, minute puberulis vel glabris; floribus circiter 2 mm longis.

A tree, glabrous except the minutely puberulent branchlets and inflorescences. Branches terete, grayish brown, smooth, the branchlets slender, straw-colored. Leaves coriaceous, rigid, oblong-ovate to oblong-elliptic, obtuse to rounded, often slightly retuse, 4 to 8 cm long, 2 to 3.5 cm wide, base acute to slightly decurrent-acuminate, pale and slightly shining when dry, the midrib impressed on the upper surface; lateral nerves slender, obscure, 8 to 10 on each side of the midrib, slightly impressed on the lower surface as are the rather obscure reticulations, the lower surface minutely and densely puncticulate; petioles 4 to 8 mm long. Inflorescences axillary on the ultimate branchlets, lax, many-flowered, 7 to 10 cm long, minutely puberulent. Flowers white, very numerous, about 2 mm long, their pedicels 1 mm long or less, the bracts broadly ovate, about 0.5 mm long, slightly ciliate. Calyx 0.7 mm in diameter, shallowly 4-lobed. Corolla cup-shaped, about 2 mm long, the lobes very short, rounded.

Kwangtung Province, Tung Sing, *K. K. Ts'oong 1860*, June 19, 1918.

A species probably most closely allied to *Ligustrum japonicum* Thunb., but with differently shaped, obtuse to rounded and often retuse, not acuminate leaves.

APOCYNACEAE

ICHNOCARPUS R. Brown

ICHNOCARPUS VOLUBILIS (Lour.) comb. nov.

Gardenia volubilis Lour. Fl. Cochinch. (1790) 148, ed. Willd. (1793) 184; DC. Prodr. 4 (1830) 383.

Ichnocarpus ovatifolius A. DC. Prodr. 8 (1844) 435; Hook. f. Fl. Brit. Ind. 3 (1882) 670.

Ichnocarpus navesii Rolfe in Journ. Linn. Soc. Bot. 21 (1884) 313.

Carruthersia daronensis Elm. Leafl. Philip. Bot. 4 (1912) 1450.

Kwangtung Province, Yamchow, *K. K. Ts'oong 1853*, June 15, 1918.

This species is recorded from Kwangtung Province by Dunn and Tutcher as *I. ovatifolius* A. DC. Loureiro's type was from the vicinity of Canton, and is preserved in the herbarium of the Paris Museum. Doctor Gagnepain, who has examined it for me, states that it is identical with *Ichnocarpus ovatifolius* A. DC., and accordingly Loureiro's specific name is here adopted for it. The species is not always easily distinguished from *I. frutescens* (Linn.) R. Br. Loureiro's description of the fruits must be excluded, as he apparently added the data to make the description conform to *Gardenia* without having seen actual fruits of the species.

POTTSIA Hooker and Arnott

POTTSIA LAXIFLORA (Blume) O. Ktze. Rev. Gen. Pl. (1891) 416.

Vallaris laxiflora Blume Bijdr. (1826) 1043.
Parsonsia ovata Wall. Cat. (1829) no. 1630, *nomen nudum.*
Pottsia ovata A. DC. Prodr. 8 (1844) 442.
Pottsia cantonensis Hook. & Arn. Bot. Beechey's Voy. (1836) 199, *t. 43.*
Teysmannia laxiflora et *hookeriana* Miq. in Versl. Med. Akad. Kon. Wetensch. 6 (1857) 194, Fl. Ind. Bat. 2 (1857) 455, 456.
Euthodon paniculata Griff. Notul. 4 (1854) 84.
Parapottsia hookeriana et *laxiflora* Miq. Fl. Ind. Bat. 2 (1859) 1080.

Kwangsi Province, Hengchow, *K. K. Ts'oong 1817*, June 2, 1918: Kwangtung Province, *F. A. McClure 7192*, July, 1921.

The species is recorded here chiefly with the view to enumerating its synonyms, the oldest specific name being adopted.

TABERNAEMONTANA Linnaeus

5924

TABERNAEMONTANA CHINENSIS sp. nov.

Frutex erectus, glaber; foliis in siccitate brunneo-olivaceis, oblongis ad lanceolatis, saepe breviter falcatis, subcoriaceis, rigidis, usque ad 10 cm longis, utrinque subaequaliter angustatis, apice obtuse acuminatis, basi cuneatis, nervis utrinque 8 ad 10, tenuibus, reticulis, subobsoletis; cymis paucifloris, circiter 2 cm longis; corollae tubo circiter 1.8 cm longo, lobis patulis, 1.5 cm longis; calycis segmentis orbicularibus, rotundatis, intus ad basim minute 3-glandulosis; folliculis immaturis oblongo-ovoideis, rostratis, leviter falcatis, 12 ad 15 mm longis, teretibus.

An erect glabrous shrub, the branches and branchlets terete, the former grayish, the latter slender, olivaceous. Leaves of each pair subequal, sometimes unequal, oblong to lanceolate, often somewhat falcate, subcoriaceous, rigid, brittle, 5 to 10 cm

long, 1.5 to 2.5 cm wide, dark olivaceous when dry, slightly shining, paler and more brownish beneath, subequally narrowed to the cuneate base and the obtusely acuminate apex; lateral nerves slender, 8 to 10 on each side of the midrib, the reticulations subobsolete; petioles 5 to 7 mm long. Cymes few-flowered, usually only one or two flowers persisting, simple or branched from the base, about 2 cm long, excluding the flowers. Flowers white. Calyx 3 to 4 mm long, the lobes orbicular, 2 mm in diameter, rounded, margins minutely ciliate, each with a group of three minute oblong glands on the inner face near the base. Corolla tube cylindric, about 1.8 cm long, the lobes spreading, oblong-obovate, rounded, 1.5 cm long, 7 mm wide. Anthers 1.5 mm long. Young follicles oblong-ovoid, rostrate, terete, or with a single obscure ridge on the ventral face, somewhat falcate, 12 to 15 mm long, about 7 mm in diameter.

Kwangtung Province, Tung Sing, *K. K. Ts'oong 1977*, July 11, 1918.

Striking characteristics of this species are its narrow leaves, the reticulations obsolete or nearly so; its few-flowered cymes; and its small, rostrate follicles, which are terete or with at most a single obscure ridge on the ventral surface.

ASCLEPIADACEAE

STREPTOCAULON Wight and Arnott

STREPTOCAULON TOMENTOSUM Wight & Arn. Contrib. Ind. Bot. (1834) 64; DC. Prodr. 8 (1844) 496; Forbes & Hemsl. in Journ. Linn. Soc. Bot. 26 (1889) 101.

Kwangtung Province, Tung Sing, *K. K. Ts'oong 1844*, June 11, 1918, with the local name *lo mo*.

New to Kwangtung Province, but recorded from China, without locality, by de Candolle, and from Yunnan by Forbes and Hemsley. Indo-China to Malaysia.

VERBENACEAE

PREMNA Linnaeus

PREMNA MICROPHYLLA Turcz. in Bull. Soc. Nat. Mosc. 36 [2] (1863) 217; Forbes & Hemsl. in Journ. Linn. Soc. Bot. 26 (1890) 256.

Kwangtung Province, Tung Sing, *K. K. Ts'oong 1872*, June 22, 1918, with the local name *pau ping*.

Japan and central China; not previously recorded from Kwangtung Province.

SCROPHULARIACEAE

BOTRYOPLEURON Hemsley

BOTRYOPLEURON LONGISPICATUM sp. nov.

Frutex erectus, parce ramosus, circiter 1 m altus, inflorescentiis perspicue castaneo-capitato-glanduloso-pubescentibus exceptis glaber; foliis coriaceis, nitidis, ovatis ad oblongo-ovatis, 8 ad 13 cm longis, perspicue acuminatis, acute serratis, nervis utrinque 3 vel 4, subtus valde elevatis, arcuato-anastomosantibus; inflorescentiis axillaribus, solitariis, spicatis, 10 ad 18 cm longis, cum floribus castaneo-capitato-glanduloso-pubescentibus, bracteolis lanceolatis, 4 ad 4.5 mm longis, inferioribus longioribus, dentatis; floribus numerosis, confertis, sessilibus, 6 ad 7 mm longis.

An erect, sparingly branched shrub, about 1 m high, glabrous except the conspicuously castaneous, capitate-glandular-pubescent inflorescences, the stems terete, castaneous, smooth, 4 to 5 mm in diameter, the ultimate branchlets about 2 mm in diameter, slightly angled. Leaves coriaceous, ovate to oblong-ovate, shortly petioled, 8 to 13 cm long, 4 to 7 cm wide, narrowed upward to the conspicuously acuminate apex, the base rounded to broadly acute, the margins coarsely and sharply serrate, the upper surface when dry often nearly black, shining, the lower surface somewhat brownish; lateral nerves 3 or 4 on each side of the midrib, distant, slightly impressed on the upper surface, very prominent on the lower surface, arched-anastomosing; petioles stout, 2 mm long or less. Inflorescences axillary, solitary, spicate, 10 to 18 cm long, shortly peduncled, the rachis, bracts, and flowers rather conspicuously castaneous-capitate-pubescent. Flowers all sessile, numerous, crowded, pale-blue, the subtending bracteoles lanceolate, acuminate, 4 to 4.5 mm long, the lower ones larger, persistent, distinctly toothed and up to 1 cm long. Corolla tube about 5 mm long, castaneous-pubescent externally, the lobes ovate, acute or acuminate, 1.5 to 2 mm long, the tube somewhat hirsute inside in the upper part. Calyx lobes lanceolate, acuminate, pubescent, 2 to 3 mm long. Stamens exserted, the filaments 8 mm long, somewhat ciliate-hirsute in the lower part; anthers ellipsoid, 2 mm long. Ovary ovoid-ellipsoid, pubescent, 2 mm in length.

Kwangtung Province, Maan Chi Shaan, *C. C. C. 8728*, collected by *Wai Tak*, September 25, 1921. In ravines.

A species allied to *Botryopleuron venosum* Hemsl. and *B. stenostachyum* Hemsl. from both of which it is at once distin-

guished by its conspicuously castaneous-capitate-glandular-pubescent inflorescences, the indumentum being of the same type on the rachis, bracts, calyces, and corollas. It is the first representative of the genus to be found in Kwangtung Province.

ACANTHACEAE

THUNBERGIA Linnaeus f.

4425 **THUNBERGIA CHINENSIS** sp. nov.

Species *T. grandiflorae* affinis, differt foliis minoribus, integris, floribus minoribus, circiter 4 cm longis, plerumque axillaribus, binis vel solitariis, bracteis pubescentibus, 2 ad 2.5 cm longis.

A scandent herbaceous vine up to 4 m or more in length, more or less pubescent; the branches and branchlets slender, terete. Leaves ovate, deeply cordate, slenderly and sharply acuminate, entire, chartaceous, 5 to 9 cm long, 4 to 6 cm wide, more or less pubescent on both surfaces. Flowers pale blue or purplish, about 4 cm long, chiefly axillary, solitary or in pairs, sometimes in short racemes terminating lateral branches, their pedicels 2.5 to 3 cm long. Bracts 2 to 2.5 cm long, oblong-ovate, subacute, base truncate-rounded, cinereous-puberulent or pubescent. Calyx a truncate pubescent ring 4 to 5 mm in diameter. Corolla tube abruptly contracted about 4 mm from the base, then expanded, the limb up to 4 cm in diameter. Anthers 10 to 11 cm long.

Kwangtung Province, Wa Shau Toi, *Levine & McClure 6957* (type), September, 1921, growing on trees and walls; Tangiin, *Groff 4049*, July, 1919, on slopes, scrambling over bamboo, with the local name *koto ma tang*. Hainan, Kungchow, *McClure 7644*, October 14, 1921, common in dry thickets.

A species manifestly allied to *Thunbergia grandiflora* Roxb., but with much smaller, pubescent, sharply acuminate, entire leaves which are not at all lobed, while its flowers are only about one-half as large as are those of Roxburgh's species.

RUBIACEAE

HEDYOTIS Linnaeus

13051 **HEDYOTIS PLATYSTIPULA** sp. nov.

Erecta, glabra, suffruticosa, circiter 40 cm alta, parce ramosa; foliis petiolatis, oblongo-ovatis ad oblongo-lanceolatis, membranaceis, laevis, 8 ad 12 cm longis, apice acute acuminatis, basi abrupte angustatis et leviter decurrento-acuminatis, nervis utrinque circiter 6, perspicuis; stipulis magnis, reniformibus, usque ad 1.5 cm latis et 1 cm longis, margine tenuiter lacerato-

dentatis, dentibus linearis, usque ad 1.5 mm longis; floribus numerosis, confertis glomeratis, axillaribus, glomerulis, circiter 2 cm diametro, calycis lobis foliaceis, lanceolatis, acuminatis, circiter 8 mm longis.

An erect, glabrous, sparingly branched, suffrutescent herb, about 40 cm high, the stems about 4 mm in diameter, sulcate when dry. Leaves oblong-ovate to oblong-lanceolate, membranaceous, olivaceous, 8 to 12 cm long, 2.5 to 4 cm wide, smooth, narrowed upward to the sharply acuminate apex, the base abruptly narrowed and somewhat decurrent-acuminate, the midrib very prominent; lateral nerves about 6 on each side of the midrib, distinct, curved-ascending, the reticulations obscure; petioles 1 to 1.8 cm long; stipules large and conspicuous, rather thin, the older ones reniform, about 1.5 cm wide, up to 1 cm long, broadly rounded, the margins cut into numerous, slender, linear teeth or lobes which do not exceed 1.5 mm in length, the younger stipules 1 cm or less in width. Flowers numerous, subsessile, crowded in dense, axillary fascicles up to 2 cm in diameter, for the most part inclosed by the large, persistent stipules. Calyx tube about 1.2 mm long, the lobes foliaceous, lanceolate, acuminate, about 8 mm long, 2 mm wide. Corolla not seen.

Kwangtung Province, Tung Sing, *K. K. Ts'oong 1915*, June 26, 1918.

A very characteristic species easily recognized by its dense axillary fascicles, and especially by its very large, persistent, reniform stipules which for the most part conceal the flowers. It apparently belongs in the group with *Hedyotis thwaitesii* Hook. f.

WENDLANDIA Bartling

WENDLANDIA GLABRATA DC. Prodr. 4 (1830) 411.

Kwangtung Province, Tung Sing, *K. K. Ts'oong 3779*, June 26, 1918, with the local name *ha so muk*.

Previously recorded from China only from Yunnan; India to Java, Riu Kiu Islands, Formosa, and the Philippines.

CAMPANULACEAE

PENTAPHRAGMA Wallich

PENTAPHRAGMA SPICATUM sp. nov.

Herba suffruticosa, plus minusve sordide pubescens; foliis chartaceis, supra olivaceis, glabris, subtus pallidis, junioribus pubescentibus, inaequilateralibus, ellipticis, 10 ad 18 cm longis, apice rotundatis, basi acutis ad obtusis, nervis utrinque circiter 4, adscendentibus, subtus perspicuis, petiolo 1.5 ad 3 cm longo;

inflorescentiis spicatis, hand scorpoideis, axillaribus, 4 ad 5 cm longis; floribus paucis, 12 mm longis, calycis basi acutis, lobis elliptico-ovatis, 4 mm longis, petalis oblongis, acutis, quam sepalis paullo longioribus.

A suffrutescent perennial herb, the stems about 6 cm high, the younger parts and petioles rather densely dirty-pubescent, the indumentum on the lower surface of the younger leaves similar to that on the petioles, more or less deciduous, the older leaves glabrous or nearly so. Leaves chartaceous, olivaceous, distinctly inequilateral, elliptic, 10 to 18 cm long, 5 to 10 cm wide, the apex rounded, the base acute to obtuse, one side of the lamina usually somewhat longer than the other, the margins obscurely undulate-toothed, the upper surface olivaceous, glabrous, the lower surface pale and densely pubescent when young, ultimately glabrous or nearly so; lateral nerves about 4 on each side of the midrib, ascending, distinct on the lower surface; petioles densely pubescent, 1.5 to 3 cm long. Inflorescence axillary, peduncled, about 4 to 5 cm long, pubescent, the peduncles about 3 cm long, slender, the flowers somewhat crowded toward the apex, not at all scorpoid. Flowers white, subsessile, about 12 mm long, glabrous or nearly so. Calyx tube ellipsoid, about 8 mm long, 4 to 5 mm in diameter, base acute, lobes elliptic-ovate, rounded, about 4 mm long, 3 mm wide. Petals oblong, 5 to 6 mm long, 2 to 2.5 mm wide, acute. Anthers oblong, 2 mm long. Style 3 mm long, stout; stigma narrowly oblong, 2 to 2.2 mm long. Bracts membranaceous, elliptic to oblong-elliptic or spatulate, obtuse, 6 mm long, somewhat pubescent.

Kwangtung Province, Tung Sing, *K. K. Ts'oong 1907*, June, 1918. Hainan, *McClure 8675*, December, 1921. In forested ravines, altitude about 1,400 meters.

This is the second representative of the genus to be found in China. One striking distinguishing character is its spicate, non-scorpoid inflorescences.

COMPOSITAE

ECHINOPS Linnaeus

ECHINOPS DAHURICUS Fisch. Cat. Hort. Gorenk. (1808) 37, ex DC. Prodr. 6 (1837) 523; Hemsl. in Journ. Linn. Soc. Bot. 23 (1888) 459.

Kwangtung Province, Lin District, *Levine 3182*, September, 1918, with the local name *yung kau*.

Siberia to Japan as far south as Fokien Province and Formosa. The genus is new to Kwangtung; the specimen was originally referred, with doubt, to *Saussurea affinis* Spreng.

ILLUSTRATION

TEXT FIGURE

FIG. 1. Branchlets of *Fokienia* Henry and Thomas. *a*, *F. maclurei* Merr. sp. nov.; *b*, *F. hodginsii* Henry and Thomas.

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ADDITIONS TO OUR KNOWLEDGE OF THE BORNEAN FLORA

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In the following contribution nineteen new species of Bornean plants are described, while seven previously described forms are recorded for the first time from Borneo. These notes and descriptions were written in 1918 and 1919, but in studying the extensive collections made by Maximo Ramos in British North Borneo in 1920 and in preparing for publication an extensive paper based largely on this collection,[1] the fact was overlooked that the following notes and descriptions had not been published. The only changes made are the addition of references to specimens collected since the original manuscript was completed.

In the paper submitted for publication in Singapore over one hundred new species are proposed and described, while fifty-eight previously described forms are credited to Borneo for the first time. These contributions, with others, bring the list of known Bornean species of flowering plants up to approximately 5,250; the number in my enumeration of Bornean plants,[2] the manuscript of which was completed in January, 1918, being 4,924.

[1] Merrill, E. D., New or noteworthy Bornean plants, Part 1, Journ. Str. Branch Roy. As. Soc. **85** (1922) 151–201 et seq.

[2] Merrill, E. D., A bibliographic enumeration of Bornean plants, Journ. Str. Branch Roy. As. Soc. Extra Number (1921) 1–637.

POTHOS Linnaeus

POTHOS MIRABILIS sp. nov. § *Allopothos, Longevaginati.*

Ramis 3 ad 4 mm diametro; foliis chartaceis vel subcoriaceis, oblongis, nitidis, leviter inaequilateralibus, usque ad 26 cm longis, tenuiter acuminatis, basi acutis, nervis collectivis marginalibus vel submarginalibus, lateralibus tenuibus, curvatis, numerosis, utrinque circiter 30; petiolis longe vaginantibus, 7 ad 9 cm longis; inflorescentiis solitariis, longe pedunculatis, spathis membranaceis, in siccitate brunneis, nitidis, valde reticulatis, tenuiter acuminatis, circiter 40 cm longis et 2 cm latis; spadicibus pedunculatis, circiter 10 cm longis et 5 mm diametro.

A scandent, apparently branched plant, the branches 3 to 4 mm in diameter. Leaves oblong, shining, pale greenish when dry, 20 to 26 cm long, 6 to 8 cm wide, slightly inequilateral, subequally narrowed to the acute base and the slenderly acuminate apex, chartaceous or subcoriaceous, the collective longitudinal nerves marginal or submarginal, one at the very edge of the leaf, the other about 2 mm from the margin, the lateral nerves numerous, slender, about 30 on each side of the midrib; petioles 7 to 9 cm long, sheathing, the upper 1 cm terete, the sheathing parts 1 cm wide or less (when spread). Inflorescences solitary, their peduncles slender, about 10 cm long. Spathes membranaceous, brown and shining when dry, translucent, linear-lanceolate, very long, about 40 cm long and 2 cm wide, slenderly acuminate, base decurrent along the peduncle, acute. Spadix cylindric, about 10 cm long and 5 mm in diameter, stipitate, the stipe about 2.5 cm long. Fruits cylindric, about 1 cm long, 1-seeded.

British North Borneo, Labuk and Sugut Districts, in the flat country of the Sumawang River valley, *Agama 664,* September 21, 1918, altitude about 20 meters; Batu Lima, *Ramos 1260,* October, 1920, *Elmer 20364,* November, 1920.

A most remarkable species on account of its greatly elongated spathes which are about 40 cm long and 2 cm wide, brown, shining, translucent when dry, and prominently reticulate. It is possible that this should be treated as the type of a new genus allied to *Pothos,* but for the present it seems best to refer it to *Pothos,* § *Allopothos, Longevaginati.* It is remote from all known species of the genus.

QUERCUS Linnaeus

QUERCUS BORNEENSIS sp. nov. § *Pasania.*

Arbor plus minusve ferrugineo-pubescentibus; foliis chartaceis, oblongis ad oblongo-lanceolatis vel oblongo-oblanceolatis,

usque ad 26 cm longis, basi acutis, apice tenuiter acuminatis, nervis utrinque 11 ad 13, subtus perspicuis; infructescentiis spicatis, fructibus sessilibus, cupulis obconicis, 1.7 cm longis, 1.5 ad 2 cm latis; glans cylindraceis, 2.8 ad 3.2 cm longis, 1.2 cm diametro.

A tree 10 to 15 m high, the branchlets, petioles, and leaves on the midrib and lateral nerves beneath softly ferruginous-pubescent. Leaves chartaceous, oblong to oblong-lanceolate or oblong-oblanceolate, entire, 15 to 26 cm long, 4 to 7 cm wide, pale when dry, shining, the base usually acute, apex slenderly acuminate; lateral nerves 11 to 13 on each side of the midrib, prominent on the lower surface, arched-anastomosing, the reticulations lax, distinct; petioles 7 to 10 mm long. Infructescences spicate, peduncled, 10 to 18 cm long, ferruginous-pubescent, the fruits somewhat crowded, sessile. Cups obconic, ferruginous-pubescent, truncate, about 1.7 cm long, 1.5 to 2 cm in diameter, the scales in numerous rows, their free tips 1 mm long or less. Glans brown, shining, glabrous, cylindric or sometimes slightly narrowed below, 2.8 to 3.2 cm long, about 1.2 cm in diameter.

British North Borneo, Tawao, *D. D. Wood 450, 627* (type), June 5, 1917, and May 17, 1918. In forests at low altitudes.

In vegetative characters and in the shape of its cups this species strongly resembles *Quercus ochracea* (Schottky) Merr. The leaves, however, are thinner and much less pubescent, while the glans are entirely different in shape; in the latter species the glans are ellipsoid to obovoid and about as wide as long.

FICUS Linnaeus

FICUS INAEQUIPETIOLATA sp. nov. § *Eusyce*.

Frutex erectus, 1 ad 3 m altus; foliis alternis, chartaceis, oblongis, 10 ad 22 cm longis, basi plus minusve angustatis, obtusis vel rotundatis, 3-nervis, apice tenuiter acuminatis, margine distanter dentatis, utrinque scaberulis, costa utrinque ciliato-hispidis; nervis utrinque circiter 8, conspicuis; petiolo 1 ad 7 cm longo; receptaculis axillaribus, solitariis, sessilibus, globosis, scaberulis, 10 ad 12 mm diametro; pedicellis et perianthii segmentis perspicue longe pallide ciliatis.

An erect shrub 1 to 3 m high, the branches rather slender, terete, rugose when dry, glabrous, usually reddish brown, the very young branchlets sparingly hispid with short, thick, stiff, scattered hairs. Leaves alternate, chartaceous, olivaceous to yellowish green when dry, shining, usually oblong, sometimes oblong-obovate, 10 to 22 cm long, 4 to 8.5 cm wide, somewhat narrowed below to the rounded or obtuse, distinctly 3-nerved

base, the apex rather slenderly acuminate, margins distantly and not very conspicuously dentate, the upper surface rather harsh from scattered, short, stiff, spreading hairs from thickened bases, the midrib on both surfaces rather densely ciliate-hispid, the lower surface with scattered, stiff, short hairs on the nerves and reticulations; lateral nerves above the basal pair about 8 on each side of the midrib, spreading, curved, arched-anastomosing near the margin, very prominent on the lower surface, the reticulations lax, prominent; petioles exceedingly variable in length, 1 to 7 cm long, more or less hispid; stipules lanceolate, acuminate, about 8 mm long, pubescent. Receptacles axillary, solitary, yellow when fresh, globose, sessile, 10 to 12 mm in diameter, hispid with short, stiff, scattered hairs, the basal bracts broadly ovate, acute, sparingly pubescent, about 2 mm long. Male flowers few and only near the ostiole, their pedicels about 1 mm long, conspicuously ciliate with long spreading hairs; segments 4, oblong-obovate to oblong, membranaceous, 1.5 mm long, glabrous or with very few hairs; stamens 2, the anthers about 0.8 mm long. Gall flowers very numerous, their pedicels slender up to 3 mm long, densely ciliate with long white hairs, 1.5 to 2 mm long; segments membranaceous, spatulate, prominently ciliate with long, white, 2 to 2.5 mm long hairs. Fertile female flowers in separate receptacles, similar to the gall flowers, their segments shorter; ovary inequilaterally obovoid, about 1.2 mm long, rather conspicuously rugose and distinctly keeled on the inflated side; styles glabrous, 1.5 mm long.

British North Borneo, Sandakan, *Castillo 602* (type), February 14, 1918, *Agama 485*, January, 1917, *Villamil 178*, March, 1916, *Ramos 1885*, November, 1920. In thickets on slopes at low altitudes.

This characteristic species is manifestly allied to *Ficus leucoptera* Miq., from which it is distinguished by many characters, notably its sessile receptacles; its scattered, stiff, short, hispid hairs, and the entire absence of soft appressed hairs; its dentate leaf margins; and its conspicuously long-ciliate pedicels and perianth segments.

OROPHEA Blume

OROPHEA MYRIANTHA sp. nov.

Arbor parva, leviter adpresse pubescentibus; foliis oblongis ad oblongo-ellipticis, chartaceis, 15 ad 22 cm longis, basi rotundatis ad obtusis, apice late acuminatis, nervis utrinque 8 ad 12, perspicuis; inflorescentiis axillaribus vel extra-axillaribus, multifloris, fasciculatis vel depauperato-cymosis, 4 ad 5 cm

diametro, confertis; sepalis ovatis, 3.5 mm longis, utrinque pubescentibus; petalis exterioribus elliptico-ovatis, utrinque angustatis, 6 mm longis, interioribus arcuatis, 7 mm longis; staminibus 12; carpellis 5, pubescentibus.

A tree about 10 m high, the branchlets, petioles, and midrib and nerves on the lower surface of the leaf sparingly appressed-pubescent, the inflorescences densely appressed-pubescent with gray hairs. Leaves oblong to oblong-elliptic, chartaceous, 15 to 22 cm long, 6.5 to 9 cm wide, base rounded to obtuse, apex broadly acuminate, the acumen blunt, sometimes apiculate; lateral nerves 8 to 12 on each side of the midrib, rather prominent beneath, ascending, anastomosing, the reticulations slender, not prominent; petioles about 5 mm long. Inflorescences axillary or extra-axillary, of many-flowered fascicles or sometimes of congested short cymes, the inflorescences 4 to 5 cm in diameter, with from 25 to 40 flowers. Flowers yellow, odorless, their pedicels 1.5 to 2 cm long, rather slender, the median bracteole oblong-ovate, acuminate, 4 mm long. Sepals ovate, 3.5 mm long, 3 mm wide, acute or slightly acuminate, pubescent on both surfaces. Outer petals elliptic-ovate, narrowed at both ends, pubescent, acute or slightly obtuse, 6 mm long, 5 mm wide; inner petals arched, about 7 mm long, the claw stout, glabrous, 3 mm long, the limb subrhomboid, 4 to 5 mm wide, pubescent on both surfaces above. Stamens about 12, about 1 mm long. Carpels usually 5, oblong, inequilateral, pubescent, 1.2 mm long.

British North Borneo, Tawao, *Agama 544*, May 11, 1918. In flat country along Brantion River, slightly above sea level, with the Malay name *banitan*.

The striking character by which this species may be distinguished is its very many-flowered inflorescences, some of which contain at least forty flowers; they are either in fascicles or in greatly congested, sometimes short-peduncled cymes.

LUNASIA Blanco

LUNASIA GIGANTIFOLIA sp. nov.

Frutex circiter 3 m altus, partibus junioribus lepidotis; foliis oblongis, chartaceis vel membranaceis, nitidis, usque ad 50 cm longis et 20 cm latis, integris, basi angustatis, cuneatis, apice perspicue acuminatis, nervis utrinque circiter 26, subtus valde conspicuis; inflorescentiis ♀ tenuibus, circiter 7 cm longis, subracemosis, paucifloris; floribus fasciculatis, vel in ramulis brevissimis dispositis; petalis oblongo-ovatis, obtusis, 2.5 mm longis.

A shrub about 3 m high, the branchlets, petioles, inflorescences, and the midrib and nerves at least in young leaves densely

lepidote with small scales. Branches somewhat triangular, the angles rounded. Leaves oblong, chartaceous or membranaceous, green when dry, shining, when young with scattered lepidote scales on both surfaces, the older ones becoming nearly glabrous, 38 to 50 cm long, 14 to 20 cm wide, entire, base narrowed, cuneate, apex rather prominently acuminate; lateral nerves about 26 on each side of the midrib, very prominent on the lower surface, the primary reticulations slender, distinct, subparallel; petioles 9 to 15 cm long. Pistillate inflorescences axillary, slender, about 7 cm long, subracemose, few-flowered, densely lepidote, the flowers fascicled or on very short branches, their pedicels 1 mm long or less. Sepals ovate, 1.5 mm long, acute, lepidote, petals 3, oblong-ovate, obtuse, 2.5 mm long, glabrous. Ovary very deeply 3-cleft, densely lepidote, lobes ovoid, inequilateral, about 1.2 mm long. Staminodes 3, shorter than the lobes of the ovary.

British North Borneo, Sandakan, *Agama 582*, August 22, 1918. On rocky ridges, altitude about 25 meters.

This species is well characterized by its very large leaves. It is manifestly allied to the Philippine *Lunasia macrophylla* Merr. from which it is easily distinguished by its membranaceous, much fewer-nerved leaves and much longer petioles.

CHISOCHETON Blume

CHISOCHETON POLYANDRUS sp. nov.

Arbor parva, ramis glabris vel subglabris; foliis usque ad 50 cm longis, foliolis plerumque 10, oppositis et alternis, oblongis, usque ad 27 cm longis, chartaceis, tenuiter acuminatis, basi leviter inaequilateralibus, angustatis, supra pallidis, glabris vel costa nervisque plus minusve puberulis vel pubescentibus, subtus subadpresse hirsutis, nervis utrinque circiter 15; inflorescentiis solitariis, in axillis superioribus, angustis, foliis subaequantibus, ut videtur pendulis, longe pedunculatis, partibus junioribus ferrugineo-pubescentibus; floribus subfasciculato-cymosis, rubris, numerosis, crassis, extus dense ferrugineo-pubescentibus, 3 ad 3.5 cm longis; petalis plerumque 6, inferne cum tubus stamineus coalitis; tubo stamineo extus glabro, intus patule hirsuto, apice laciniato, laciniis numerosis; antheris 12 ad 14.

A small tree, the branches dark reddish brown, glabrous or nearly so. Leaves up to 50 cm in length, the leaflets opposite and alternate, usually 10, oblong, chartaceous, 11 to 27 cm long, 5 to 7 cm wide, sometimes a few greatly reduced leaflets present below, slenderly acuminate, base narrowed, somewhat inequi-

lateral, the upper surface glabrous or the midrib and nerves somewhat puberulent, pale, shining, the lower surface appressed-hirsute with scattered hairs; lateral nerves distinct, about 15 on each side of the midrib; petiolules 2 mm long or less. Inflorescences narrow, in the upper axils, solitary, apparently pendulous, long-peduncled, about as long as the leaves, the younger parts ferruginous-pubescent. Flowers stout, 3 to 3.5 cm long, fasciculate-cymose, the depauperate cymes very short, scattered along the rachis. Calyx densely ferruginous-pubescent, truncate, cup-shaped, 5 to 8 mm long, 5 to 6 mm in diameter. Petals externally densely pubescent, coriaceous, subspatulate, usually 6, coalescing with the tube below. Staminal-tube glabrous externally, cylindric, the apex multifid, the laciniae linear, about 3 mm long, the tube inside glabrous in the lower and upper 5 mm, otherwise conspicuously hirsute with scattered, spreading hairs. Disk thick, truncate, 1 mm high, glabrous. Anthers 12 to 14, oblong, 4 mm long, appressed-hirsute with long scattered ferruginous hairs on the back. Style filiform, glabrous; stigma subcapitate, about 1 mm in diameter.

British North Borneo, Labuk, *D. D. Wood 657*, September 30, 1918. Near the banks of streams at low altitudes. Batu Lima, *Ramos 1217*. In damp forests at low altitudes. *Villamil 226*, in fruit, is probably referable here.

A species well characterized by its slender, elongated, very narrow inflorescences which are apparently pendulous; its stout, densely ferruginous-pubescent, mostly 6-merous flowers; and its numerous anthers. It does not appear to be closely allied to any previously described species but apparently belongs in the group with *Chisocheton penduliflorus* Hiern.

AGLAIA Loureiro

AGLAIA LUZONIENSIS (Vidal) Merr. & Rolfe in Philip. Journ. Sci. 3 (1908) Bot. 105.

Beddomea luzoniensis Vidal Rev. Pl. Vasc. Philip. (1886) 84.
Aglaia monophylla Perk. Frag. Fl. Philip. (1904) 33.
Aglaia unifoliolata Koord. in Meded. Lands Plantent. 19 (1908) 635.

British North Borneo, Suanlamba River, *Castillo 655*, August 19, 1918; Batu Lima, *Ramos 1184, 1464, 1595*. In forests at low altitudes.

Very common and widely distributed in the Philippines, extending to Celebes and New Guinea; new to Borneo.

APOROSA Blume

APOROSA GRANDISTIPULA sp. nov.

Arbor parva, glabra; foliis oblongis, integris, chartaceis ad subcoriaceis, 20 ad 30 cm longis, 9 ad 10 cm latis, nitidis, basi

rotundatis vel angustatis, semper auriculato-cordatis, apice abrupte acuminatis, nervis utrinque 17 ad 20, supra haud impressis, subtus valde perspicuis; petiolo 3 ad 4.5 cm longo; stipulis subcoriaceis, persistentibus, late acinaciformibus, usque ad 2.5 cm longis et 1.5 cm latis; infructescentiis lateralibus, pedunculatis, solitariis, 2.5 ad 3.5 cm longis, fructibus plerumque 2, longe pedicellatis, ovoideis, 1.5 ad 1.8 cm longis, 3-locellatis, pericarpio fragile, 1.5 mm crasso.

A glabrous tree about 6 m high. Leaves oblong, entire, firmly chartaceous to subcoriaceous, 20 to 30 cm long, 9 to 10 cm wide, grayish olivaceous when dry, shining, the base rounded, sometimes distinctly narrowed, always auriculate-cordate, the apex rather abruptly acuminate; lateral nerves 17 to 20 on each side of the midrib, not impressed on the upper surface, very prominent on the lower surface, somewhat curved, arched-anastomosing, the reticulations distinct; petioles 3 to 4.5 cm long; stipules very broadly acinaciform, persistent, the same color and consistency as the leaves, up to 2.5 cm long and 1.5 cm wide, one end very broadly rounded, the other falcate-acuminate. Infructescences lateral, solitary, peduncled, each usually bearing two fruits, the peduncles up to 3.5 cm long, the pedicels up to 1 cm long. Fruits ovoid, yellow, 1.5 to 1.8 cm long, 3-celled, the pericarp rather brittle, about 1.5 mm thick.

British North Borneo, Sandakan, *Agama 579*, August 22, 1918. In flat country of the Suanlamba River valley at low altitudes.

This species belongs in the group with *Aporosa benthamiana* Hook. f. and *A. lunata* Benth. and is more closely allied to the former, from which it is distinguished especially by its fewer-nerved leaves, much longer petioles, and entirely different infructescences.

CYCLOSTEMON Blume

CYCLOSTEMON CASTILLOI sp. nov.

Arbor parva, glabra; foliis chartaceis, integris, nitidis, oblongo-ovatis ad elliptico-ovatis, 10 ad 17 cm longis, apice tenuiter acuminatis, nervis utrinque circiter 5, perspicuis, reticulis laxis; fructibus globosis, circiter 2.5 cm diametro, 2-locellatis, in siccitate brunneis, pericarpio 5 mm crasso, fragile.

A glabrous tree (flowers not seen) about 10 m high, the branchlets slender, terete. Leaves chartaceous, entire, pale olivaceous, shining, of about the same color on both surfaces, oblong-ovate to elliptic-ovate, 10 to 17 cm long, 4 to 7.5 cm wide, the base acute to rounded, sometimes slightly inequilateral, the apex slenderly acuminate; lateral nerves about 5 on each side

of the midrib, rather prominent on the lower surface, curved, anastomosing, distant, the reticulations lax, distinct; petioles 5 to 8 mm long. Fruits yellowish brown when ripe, globose, glabrous, brown when dry, solitary, on the branchlets and older branches, about 2.5 cm in diameter, 2-celled, each cell with a single seed, the pericarp about 5 mm thick, rather brittle; pedicels up to 8 mm long.

British North Borneo, Sandakan, Suanlamba watershed, *Castillo 637*, August 26, 1918. In level country at low altitudes.

This species probably is as closely allied to *Cyclostemon palawanensis* as to any other but is entirely glabrous and has larger, slenderly acuminate, fewer-nerved leaves, and apparently larger fruits although the mature fruits of the Palawan species are as yet unknown.

CYCLOSTEMON MEGACARPUS Merr. in Philip. Journ. Sci. 7 (1912) Bot. 387.

British North Borneo, Suanlamba River, *Agama 576*, August 20, 1918.

Philippines; this is the first extra-Philippine record for the species.

CROTON Linnaeus

CROTON CUMINGII Muell.-Arg. in Linnaea 34 (1865) 101, DC. Prodr. 15 [2] (1886) 566.

British North Borneo, Tawao, *D. D. Wood 628*, May 22, 1918.

New to Borneo; upper Malay Peninsula, Riu Kiu Islands, Formosa, and the Philippines.

OMPHALEA Linnaeus

OMPHALEA SARGENTII Merr. in Philip. Journ. Sci. 16 (1920) 574.

British North Borneo, Suanlamba River, *Castillo 634*, August, 1918. Malay, *lasit;* Sebuga, *Ramos 1874*, December, 1920.

The specimen cited above is an excellent match for the type, a Philippine specimen, which was from an island between Palawan and Borneo. The second species of the genus from Borneo.

ZIZYPHUS Tournefort

ZIZYPHUS LENTICELLATA sp. nov.

Frutex scandens ramulis et subtus foliis ad nervis leviter adpresse-pubescentibus; ramis ramulisque lenticellatis; spinis recurvatis, solitariis, 5 mm longis; foliis firmiter chartaceis, oblongo-ellipticis, subolivaceis, nitidis, 6 ad 11 cm longis, utrinque angustatis, apice perspicue acuminatis, basi leviter inaequilateralibus, minute cordatis, margine minute serrulatis; nervis 3,

supra impressis, subtus valde prominulis; infructescentiis axillaribus, 3 cm longis; fructibus ellipsoideis, glabris, lenticellatis, 2.5 cm longis.

A woody vine, the young branchlets and nerves on the lower surface of the leaves very sparingly appressed-pubescent. Branches and branchlets with rather numerous small lenticels, the stipular spines stout, recurved, about 5 mm long, usually only one subtending each leaf. Leaves firmly chartaceous to subcoriaceous, oblong-elliptic, subolivaceous, shining when dry, 6 to 11 cm long, 2.5 to 4.5 cm wide, narrowed at both ends, the apex prominently acuminate, the acumen blunt and usually apiculate, base slightly inequilateral, rather minutely cordate, prominently 3-nerved, the margins minutely serrulate; nerves impressed on the upper surface, the lateral pair extending into the acumen, very prominent on the lower surface, the transverse nervules and reticulations prominent; petioles 3 to 5 mm long, somewhat pubescent. Cymes axillary, more or less branched, in fruit about 3 cm long including the fruits, the latter ellipsoid, glabrous, prominently lenticellate, about 2.5 cm long.

British North Borneo, Sandakan, Suanlamba watershed, *Castillo 644*, August 9, 1918. On forested river banks, altitude about 50 meters. Batu Lima, *Agama 1018*, November, 1921.

This species in vegetative characters is very similar to *Zizyphus horsfieldii* Miq., but is especially distinguished by its ellipsoid, not globose, entirely glabrous, conspicuously lenticellate fruits.

STERCULIA Linnaeus

STERCULIA ACUMINATISSIMA sp. nov.

Arbor, inflorescentiis exceptis glabra; foliis chartaceis, oblongo-ovatis, utrinque nitidis, 16 ad 20 cm longis, basi late rotundatis, 3-nervis, apice tenuiter caudato-acuminatis, nervis utrinque circiter 5, perspicuis; inflorescentiis tenuibus, anguste paniculatis, circiter 20 cm longis, longe pedunculatis, castaneis, leviter pubescentibus; floribus 15 ad 18 mm longis, tenuiter pedicellatis, calycis tubo cylindraceo, subglabro, lobis 4 ad 6 mm longis, erectis, liberis, anguste oblongis, obtusis; ovario subsessile, dense pubescente.

A tree, glabrous except the inflorescences, the ultimate branches grayish, 5 to 7 mm in diameter. Leaves chartaceous, oblong-ovate, shining on both surfaces, 16 to 20 cm long, 8 to 9 cm wide, the base rather broadly rounded, 3-nerved, the apex slenderly caudate-acuminate, the acumen about 2 cm long, acute;

lateral nerves above the basal pair, about 5 on each side of the midrib, distant, curved, anastomosing, the reticulations lax; petioles 6 cm long; stipules not seen. Inflorescences slender, narrowly paniculate, about 20 cm long, long-peduncled, castaneous when dry, pubescent, the lower branches up to 4 cm in length. Flowers 15 to 18 mm long, their pedicels 6 to 10 mm long. Calyx tube somewhat cylindric, nearly glabrous, the lobes 4 to 6 mm long, erect, ultimately spreading, narrowly oblong, obtuse, not at all cohering even in bud, hirsute inside. Ovary ovoid, subsessile, densely pubescent; style stout, pubescent, about 1 mm long, the stigmas somewhat spreading or recurved, thickly club-shaped, about 1 mm long, the carpels 3 or 4, nearly free. Anthers 10, sessile at the base of the carpels.

Sarawak, *1383 native collector*.

This species belongs in the group with *Sterculia laevis* Wall., from which it is distinguished by its caudate-acuminate leaves and the calyx lobes being much shorter than the calyx tube.

STERCULIA HOSEI sp. nov.

Arbor, ramis admodum incrassatis, ramulis dense castaneo-pubescentibus; foliis ovatis ad oblongo-obovatis, chartaceis, 28 ad 32 cm longis, utrinque plus minusve stellato-pubescentibus, subtus ferrugineis, basi rotundatis ad truncato-rotundatis, 3-nervis, apice tenuissime caudato-acuminatis, nervis utrinque 7 vel 8, perspicuis; petiolo 7 cm longo; paniculis angustissimis, 8 ad 11 cm longis, densissime castaneo-pubescentibus; floribus circiter 12 mm longis, castaneo-pubescentibus, lobis erectis vel patulis, lineari-lanceolatis, 10 mm longis; ovario dense fulvo-hirsuto.

A tree, the branches somewhat thickened, reddish brown, rugose, glabrous, the ultimate branchlets about 6 mm in diameter, densely castaneous-pubescent. Leaves ovate to oblong-obovate, chartaceous, 28 to 32 cm long, the base rounded to broadly truncate-rounded, 3-nerved, the apex very slenderly caudate-acuminate, the acumen about 3 cm long and 1.5 mm wide, the upper surface pale greenish when dry, stellate-pubescent with short scattered hairs, the midrib rather densely castaneous, stellate-pubescent, the lower surface pale brownish, ferruginous-pubescent with stellate hairs which are more numerous on the midrib, nerves, and primary reticulations; lateral nerves above the basal pair 7 or 8 on each side of the midrib, prominent, somewhat curved, anastomosing very close to the margin, the reticulations distinct; petioles about 7 cm long, thickened at the base and apex, ferruginous-pubescent. Panicles very narrow, almost

racemelike, 8 to 11 cm long, all parts very densely castaneous-pubescent with stellate hairs, the branches at most 5 mm long, 1- to 3-flowered. Flowers about 12 mm long, very densely castaneous-pubescent with stellate hairs, the tube broad, about 3 mm long, the lobes free, erect, ultimately spreading, not at all cohering, linear-lanceolate, acuminate, about 10 mm long. Ovary ovoid, densely fulvous-hirsute, the stalk glabrous, about 2.5 mm long; style densely fulvous-hirsute, recurved, about 3 mm long. Staminate flowers similar to the perfect ones, the androphore glabrous, about 3.5 mm long.

Sarawak, Baram District, *Hose 97*, March, 1915.

This species is characterized by its very slenderly caudate-acuminate leaves and its racemelike, relatively short panicles. It is apparently as closely allied to *Sterculia scortechinii* King as to any other described species.

STERCULIA LONGIPETIOLATA sp. nov.

Arbor inflorescentiis leviter castaneo-pubescentibus exceptis glabra; ramulis circiter 1 cm diametro, stipulis numerosissimis circiter 5 cm longis, anguste lanceolatis, glabris acuminatis; foliis oblongo-obovatis, longe petiolatis, subcoriaceis, acuminatis, basi leviter cordatis, circiter 50 cm longis, nervis utrinque circiter 10, valde perspicuis; paniculis tenuibus, angustis, circiter 30 cm longis, leviter castaneo-pubescentibus; floribus circiter 8 mm longis, lobis lineari-lanceolatis, arcuatis, coherentibus, 3.5 mm longis.

A tree, nearly glabrous except the somewhat castaneous-pubescent inflorescences. Ultimate branches terete, about 1 cm in diameter, somewhat pubescent, terminated by a dense crown of narrowly lanceolate, coriaceous, glabrous, brown, shining, slenderly acuminate stipules or stipulelike bracts about 5 cm long, 6 to 8 mm wide. Leaves oblong-obovate, subcoriaceous, acuminate, base rounded or slightly cordate, up to 50 cm long and 20 cm wide, pale brownish when dry, shining, glabrous or the midrib beneath slightly stellate-pubescent with scattered ferruginous hairs; lateral nerves about 10 on each side of the midrib, very prominent, curved, anastomosing, the reticulations very distinct on the lower surface; petioles 9 to 12 cm long, stout, thickened at base and apex, slightly pubescent, ultimately glabrous. Panicles rather slender, narrow, about 30 cm long, somewhat castaneous-pubescent, the branches spreading, 2 to 4 cm long. Flowers slightly pubescent, about 8 mm long, the tube oblong-ovoid, the lobes linear-lanceolate, hirsute inside, about

3.5 mm long, arched, cohering by their apices. Androphore about 1.5 mm long, bearing a globose head of 10 anthers about 1 mm in diameter.

Sarawak, *1752 native collector*. British North Borneo, Batu Lima, *Agama 1001*, October, 1920, *Ramos 1487, 1723, 1725*, October and November, 1920. In damp forests along streams at low altitudes.

This species is strongly characterized by its rather long-petioled, nearly glabrous leaves and by the dense crown of stipules or stipulelike bracts which terminates the branchlets.

STERCULIA MEMBRANACEA sp. nov.

Frutex vix 1 m altus, partibus junioribus inflorescentiisque leviter pubescentibus, ramis ramulisque tenuibus; foliis oblongis, membranaceis, glabris, nitidis, olivaceis, 12 ad 20 cm longis, basi angustatis, acutis vel leviter obtusis, apice contractis et abrupte rostrato-acuminatis, nervis utrinque 8 ad 10; paniculis tenuissime pedunculatis, 7 ad 10 cm longis; floribus extus glabris, tenuiter pedicellatis, 5 ad 8 mm longis, lobis lineari-oblongis, arcuatis, coherentibus, tubo aequantibus.

A shrub, less than 1 m high according to the collector, the younger parts including the inflorescences slightly pubescent. Branches slender, terete, about 2 mm in diameter, glabrous, the tips of the branchlets slightly pubescent. Leaves oblong, membranaceous, glabrous on both surfaces, olivaceous, shining, 12 to 20 cm long, 4 to 8 cm wide, the base narrowed, acute or slightly obtuse, the apex abruptly contracted and rostrate-acuminate, the acumen about 1 cm long, 2 to 3 mm wide, obtuse; lateral nerves, 8 to 10 on each side of the midrib; petioles slender, glabrous or nearly so, 1 to 3 cm long. Panicles terminal, very slender, peduncled, 7 to 10 cm long, slightly pubescent, the branches few, spreading, 2 cm long or less. Flowers white, externally glabrous, about 7 mm long, their pedicels filiform, 5 to 8 mm long. Calyx tube subovoid, the lobes linear-oblong, arched, cohering, about as long as the tube, hirsute. Androphore about 1.5 mm long, the anthers crowded in a globose head about 0.5 mm in diameter.

British North Borneo, Labuk and Sagut Districts, *Castillo 665*, September 21, 1918. In flat country of the Sumawang watershed, altitude about 20 meters.

This species is closely allied to the Philippine *Sterculia graciliflora* Perk., from which it is especially distinguishable by its more-numerous lateral nerves.

STERCULIA YATESI sp. nov.

Frutex vel arbor parva, inflorescentiis exceptis glabra; stipulis numerosis, lanceolatis, acuminatis, circiter 5 mm longis; foliis chartaceis oblanceolatis, utrinque angustatis, 20 ad 30 cm longis, brevissime petiolatis, tenuiter acuminatis, nervis utrinque 15 ad 20, perspicuis; paniculis angustis, 15 ad 25 cm longis, in ramis defoliatis dispositis, bracteis numerosis stipuliformibus lanceolatis acuminatis 1.2 ad 2 cm longis subtensis; floribus circiter 17 mm longis, tenuiter pedicellatis, tubo cylindraceo, lobis curvatis, vix coherentibus, circiter 8 mm longis; fructibus anguste oblongis, basi angustatis, extus dense ferrugineo-puberulis, acutis, circiter 9 cm longis; seminibus circiter 6.

A shrub or small tree, 2 to 5 m high, glabrous or nearly so except the somewhat pubescent inflorescences, the branches terete, 4 to 7 mm in diameter, the tips of the branchlets usually glabrous and supplied with a crown of short, lanceolate, coriaceous, acuminate, stipulelike bracts, about 5 mm long. Leaves chartaceous, oblanceolate, slenderly and sharply acuminate, narrowed at both ends, the base 5 mm wide or less, obtuse, 20 to 30 cm long, 5 to 10 cm wide, brownish or olivaceous, shining, entirely glabrous on both surfaces or the upper surface slightly pubescent on the midrib; lateral nerves 15 to 20 on each side of the midrib, prominent, curved, anastomosing, the reticulations distinct; petioles glabrous or when young somewhat pubescent, 3 to 5 mm long. Specialized leafless branchlets bearing the inflorescences 8 to 15 cm long, up to 4 mm in diameter, glabrous, bearing at the apex a crown of rather rigid, narrowly lanceolate, glabrous, acuminate, brownish bracts about 1.2 to 2 cm long which subtend one to several narrow panicles, 15 to 25 cm in length, the panicles somewhat castaneous-pubescent, their branches divaricately spreading, distant, few-flowered, 2.5 cm long or less. Flowers purplish, about 17 mm long, their pedicels slender, 5 to 13 mm long. Calyx tube cylindric, the base cuneate, externally somewhat pubescent, the lobes curved, arched, not at all cohering or if so only in young bud, oblong-lanceolate, hirsute inside, about 8 mm long. Androphore glabrous, 3 mm long, the anthers 10, crowded in a globose head about 1.5 mm in diameter. Fruit narrowly oblong, somewhat compressed, usually solitary, the base narrowed into a stipe, dark red when fresh, externally densely ferruginous-puberulent, inside glabrous, apex acute, about 9 cm long and 2 cm wide. Seeds about 6, somewhat ellipsoid, about 1 cm long.

British North Borneo, Sapeng, *Yates 21* (type), October 17, 1917, in forests, altitude about 250 meters; Sandakan, Suanlamba watershed, *Agama 578*, August 21, 1918, on ridges, altitude about 15 meters, in fruit; Sarawak, Baram District, Selungo, *2817 native collector*, November 25, 1914.

This species is apparently most closely allied to *Sterculia spatulata* Warb. of the Sulu Archipelago, from which it differs in its more-numerous lateral nerves and apparently also in the specialized leafless branchlets which are terminated by a crown of narrowly lanceolate brown bracts subtending the panicles.

SAURAUIA Willdenow

SAURAUIA AGAMAE sp. nov.

Frutex perspicue adpresse-setosus; foliis chartaceis, oblongis ad oblongo-lanceolatis, usque ad 20 cm longis, basi acutis, apice tenuiter subcaudato-acuminatis, subtus adpresse-setosis; nervis utrinque 15, perspicuis; inflorescentiis cymosis, 7 ad 10 cm longis, lateralibus fasciculatis, terminalibus solitariis, dense adpresse-setosis, bracteis linearis, 4 ad 10 mm longis; sepalis extus dense adpresse-setosis; staminibus 20; ovario glabro; stylis 3, liberis.

A shrub 1 to 1.5 m high, the branchlets, petioles, leaves on the lower surface, and the inflorescences conspicuously appressed-setose, the upper surface of the leaves glabrous except the appressed-setose midrib. Leaves chartaceous, oblong to oblong-lanceolate, 13 to 20 cm long, 4 to 7 cm wide, narrowed below to the acute base and above to the slenderly subcaudate apex, the margins somewhat spinulose-setose, the upper surface shining, grayish olivaceous when dry; lateral nerves about 15 on each side of the midrib, prominent on the lower surface, somewhat curved, scarcely anastomosing, the reticulations distinct, the setae on the lower surface mostly confined to the midrib, nerves, and reticulations; petioles 1 to 3 cm long, ultimately becoming nearly glabrous. Inflorescences cymose, peduncled, in lateral fascicles on the older branches and sometimes also terminal, when terminal usually if not always solitary, 7 to 10 cm long, rather many-flowered, lax, rather densely appressed-setose and also pubescent, the indumentum pale brownish; bracts linear, setose, up to 1 cm in length. Flowers white, their pedicels 4 to 10 mm long. Sepals oblong to oblong-ovate, acute, 3 to 4 mm long, the outer 3 densely setose, the inner 2 narrower and with glabrous margins. Petals 5, oblong, about 6.5 mm long, 3 mm

wide, the apex subtruncate and slightly retuse; stamens 20, the anthers oblong, 2.5 mm long. Ovary ovoid, glabrous; styles 3, free, 3 to 3.5 mm long.

British North Borneo, Sandakan, *Agama 569*, August 4, 1918. In flat country of the Suanlamba River valley at low altitudes.

This species resembles *Saurauia acuminata* Merr., but its indumentum is very different, the setae being much shorter and appressed; the cymes much longer; and the styles free to the base.

RINOREA Aublet

RINOREA CASTILLOI sp. nov. § *Pentaloba*.

Arbor parva, novellis inflorescentiisque minute pubescentibus exceptis glabra; ramis pallidissimis, ramulis sulcatis vel compressis; foliis chartaceis, oblongis ad oblongo-ellipticis, 20 ad 30 cm longis, basi angustatis, acutis, apice acuminatis, margine minute et distanter glanduloso-serrulatis, nervis utrinque circiter 15, perspicuis; inflorescentiis axillaribus, solitariis vel fasciculatis, racemosis vel depauperato-paniculatis, paucifloris, quam petiolis brevioribus; sepalis late ovatis, rotundatis, leviter pubescentibus, circiter 3.5 mm longis.

A tree about 8 m high, entirely glabrous except the minutely pubescent tips of the growing branchlets, the stipules, and the sparingly pubescent inflorescences. Branches very pale, terete, sparingly lenticellate, branchlets compressed or sulcate. Leaves chartaceous, rather pale when dry, oblong to oblong-elliptic, 20 to 30 cm long, 7 to 11 cm wide, subequally narrowed to the acute base and to the somewhat acuminate apex, the margins entire or minutely and distantly glandular-serrulate; lateral nerves about 15 on each side of the midrib, conspicuous, the reticulations distinct on both surfaces, subparallel; petioles 2 to 3 cm long; stipules lanceolate, slenderly acuminate, about 7 mm long, minutely pubescent, somewhat keeled and longitudinally striate. Inflorescences sparingly pubescent, racemose or depauperate-paniculate, 2 cm long or less, solitary or few in each axil. Flowers perfect, their pedicels about 4 mm long; bracts ovate, acuminate, somewhat keeled, about 2 mm long; bracteoles similar to the bracts but much smaller, 1 mm long or less. Sepals 5, about 3.5 mm long, broadly ovate to reniform-ovate, rounded, slightly pubescent. Petals ovate, glabrous, rounded, 3 mm long (not quite mature). Stamens about 1.8 mm long, the filaments very short, the dorsal appendage of the connectives broadly ovate, obtuse, brown, 1 mm long, the terminal appendages of the anther cell 0.5 mm long, linear or linear-lanceolate. Ovary ellipsoid,

1 mm long, very obscurely pubescent above; style as long as the ovary.

British North Borneo, Sandakan, Suanlamba watershed, *Castillo 618*, August 22, 1918. At the base of a rocky ridge, altitude about 20 meters.

This species is distinctly allied to the Philippine *Rinorea acuminata* Merr. but differs in being nearly glabrous and by its much longer petioles; the leaf axils beneath are not glandular or bearded.

ALANGIUM Lamarck

ALANGIUM MEYERI Merr. in Govt. Lab. Publ. (Philip.) 35 (1905) 54; Wang. in Engl. Pflanzenreich 41 (1910) 15.

British North Borneo, Suanlamba River, *Agama 560*, August 7, 1918. A widely distributed Philippine species, this being its first extra-Philippine record.

DIOSPYROS Linnaeus

DIOSPYROS TOPSIOIDES King & Gamble in Journ. As. Soc. Bengal 74 [2] (1905) 223.

British North Borneo, Suanlamba River, *Castillo 638*, August 26, 1918, with the Malay name *kayu arang*.

Malay Peninsula (Perak). I suspect that the Bornean specimen, *Beccari 3052*, referred by Hiern to the Indian *Diospyros topsia* Ham. will prove to be this species rather than the one Hamilton described.

TABERNAEMONTANA Linnaeus

TABERNAEMONTANA POLYSPERMA sp. nov.

Frutex glaber, ramis ramulisque tenuibus; foliis brevissime petiolatis, in paribus aequalibus vel leviter inaequalibus, membranaceis, oblongis ad oblongo-obovatis, usque ad 24 cm longis, utrinque angustatis, basi acutis, apice tenuiter caudato-acuminatis, nervis utrinque 15 ad 20, tenuibus, curvatis; cymis axillaribus, pedunculatis, laxis, paucifloris, 12 ad 14 cm longis; floribus circiter 2.5 cm diametro, corollae tubo 2 ad 2.5 cm longo; folliculis divaricatis, subcylindraceis, 4 ad 5 cm longis, circiter 2 cm diametro, obscure tricarinatis, acutis, pericarpio crustaceo; seminibus circiter 20.

A glabrous shrub about 3 m high, the branches and branchlets slender, terete, or the branchlets somewhat compressed, the internodes 6 to 13 cm long. Leaves in equal or somewhat unequal pairs, membranaceous, oblong to oblong-obovate, 7 to 24 cm long, 3 to 9 cm wide, narrowed at both ends, the base acute,

apex slenderly caudate-acuminate, the acumen 1 to 2 cm long, usually falcate; lateral nerves 15 to 20 on each side of the midrib, slender, curved; petioles 2 mm long or less. Cymes axillary, peduncled, lax, few-flowered, 12 to 14 cm long, 10 to 12 cm wide, the peduncles 6 to 8 cm long. Flowers white, the corolla tube 2 to 2.5 cm long, the lobes spreading, somewhat obovate, up to 1.5 cm long. Follicles few, subcylindric, divaricate, 4 to 5 cm long, about 2 cm in diameter, acute or subacute at both ends, the back broadly rounded, the ventral surface obscurely 3-keeled, the pericarp fragile, smooth, pale brownish, shining. Seeds about 20, angular, about 1 cm long, the aril orange yellow.

British North Borneo, Sumawang watershed, Labuk, *Castillo 667*, September 24, 1918, on ridges at low altitudes; Batu Lima and Sibuguey, *Ramos 1633, 1714*, November, 1921.

This species is well characterized by its membranaceous, many-nerved, subsessile, caudate-acuminate leaves; its obscurely keeled, subcylindric follicles; and its numerous seeds.

PREMNA Linnaeus

PREMNA GLANDULOSA sp. nov.

Arbor parva, inflorescentiis exceptis glabra; ramulis haud lenticellatis; foliis firmiter chartaceis, oblongo-ellipticis, 13 ad 17 cm longis, integris, nitidis, basi rotundatis ad acutis, apice perspicue lateque acuminatis, subtus minute distincteque glanduloso-punctatis, nervis utrinque 6 vel 7, perspicuis; cymis terminalibus, puberulis, pedunculatis, multifloris, 13 cm latis; floribus breviter pedicellatis; calycis cupulatis, truncatis; corolla 5 ad 5.5 mm longa, glabra; fructibus globosis ad obovoideis 3.5 mm longis.

A small tree about 6 m high, entirely glabrous except the cinereous-puberulent inflorescences. Branches terete, smooth, brown when dry, the upper parts not at all lenticellate. Leaves firmly chartaceous, oblong-elliptic, olivaceous when dry, 13 to 17 cm long, 6 to 8.5 cm wide, entire, shining, base rounded to acute, apex rather prominently and broadly acuminate, the lower surface minutely but distinctly glandular-punctate; lateral nerves 6 or 7 on each side of the midrib, prominent on the lower surface, curved, anastomosing, the reticulations lax, distinct; petioles 1.5 to 2 cm long. Cymes terminal, peduncled, many-flowered, about 13 cm wide, 5 to 8 cm long, excluding the peduncle, the branches opposite, the lower ones up to 8 cm in length, the bracts linear, about 4 mm long, bracteoles very small. Flowers

white, distinctly pedicelled, the pedicels about 1 mm long. Calyx shallowly cup-shaped, glabrous or very slightly pubescent, truncate, not at all or but very obscurely toothed, about 1.5 mm in diameter. Corolla 5 to 5.5 mm long, 2-lipped, glabrous or nearly so, the upper lip 1.8 to 2 mm long, broadly ovate, rounded, retuse, the lower lip 3-lobed, the lobes ovate, rounded, 1.2 to 1.5 mm long. Style 4.5 mm long. Anthers slightly exserted. Fruits globose to slightly obovoid, about 3.5 mm long.

British North Borneo, Sandakan, Suanlamba watershed, *Castillo 652*, August 25, 1918. On ridges, altitude about 10 meters.

This species is manifestly allied to *Premna kunstleri* King & Gamble of the Malay Peninsula, but the leaves are usually acute, sometimes rounded at the base but never subcordate, the corolla is glabrous, or at most with very few short scattered hairs above, while the fruits are much smaller.

CLERODENDRON Linnaeus

CLERODENDRON PANICULATUM Linn. Mant. 1 (1767) 90; C. B. Clarke in Hook. f. Fl. Brit. Ind. 4 (1885) 593.

British North Borneo, Sandakan, *Castillo 598*, January 30, 1918. On level land near the seashore.

The species is new to Borneo. Burma, Siam, and Cochin-China, southward to the Malay Peninsula, Java, and Ternate.

PSYCHOTRIA Linnaeus

PSYCHOTRIA AGAMAE sp. nov.

Frutex scandens, glaber, ramis ramulisque tenuibus, internodiis 2 ad 6 cm longis; foliis membranaceis, oblongis, nitidis, 4 ad 7 cm longis, basi plerumque acutis, apice late obtuseque acuminatis, nervis utrinque 6, tenuibus, vix anastomosantibus, reticulis obsoletis; infructescentiis pedunculatis, laxis 6 ad 7 cm longis; fructibus oblongo-obovoideis, deorsum angustatis, basi acutis, 1 cm longis, 6 mm diametro, perspicue 8-sulcatis; seminibus perspicue sulcatis; albumine aequabile.

An entirely glabrous, woody vine, the branches slender, terete, pale, smooth, the internodes 2 to 6 cm long. Leaves membranaceous, oblong, shining when dry, 4 to 7 cm long, 2 to 3 cm wide, rather pale when dry, the base usually acute, apex broadly and obtusely acuminate; lateral nerves 6 on each side of the midrib, slender, curved, scarcely anastomosing, the reticulations obsolete; petioles 3 to 7 mm long; stipules 1.5 mm long or less, somewhat sheathing, wider than long; infructescences terminal, peduncled, rather lax, 6 to 7 cm long, the peduncles 2.5 to 3.5 cm long, the branches usually 5, opposite,

each bearing three fruits, the lower ones 3 cm long or less. Fruits oblong-obovoid, narrowed below to the acute base, 1 cm long, about 6 mm in diameter, prominently sulcate, the apex rounded, the ridges usually 8. Seeds plano-convex with two conspicuous dorsal and two marginal ridges, the albumen uniform.

British North Borneo, Sandakan, *Agama 570*, August 13, 1918. In flat country in the Suanlamba River valley, slightly above sea level.

This species has the habit and somewhat the general appearance of *Psychotria sarmentosa* Blume but is not closely allied to that species as the albumen is not at all ruminate. It is well characterized by its slender stems; its membranaceous, slenderly nerved leaves, the reticulations being entirely obsolete; and its oblong-obovoid, prominently sulcate fruits and prominently sulcate seeds.

SCHISTOSOMIASIS IN THE PHILIPPINE ISLANDS [1]

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FIVE PLATES

Schistosomiasis is considered as being of very infrequent occurrence among natives of the Philippine Islands, and its endemic nature has not been established. Up to the present only two cases of infection with *Schistosoma japonicum* had been reported at autopsy, one by Woolley(35) and the other by Phalen and Nichols.(31) It might be mentioned that Garrison(15) and Willets(34) have seen the ova of *S. japonicum* a number of times in their routine examinations of stools. Study of some post-mortem cases in our department of pathology and bacteriology has enabled us to report ten more instances of this infection in native Filipinos who have never been out of this country.

It is the purpose of this paper to give a general survey of the life history of *S. japonicum* and an account of the pathology and morbid anatomy of schistosomiasis in man, in addition to the case reports.

LIFE HISTORY OF SCHISTOSOMA JAPONICUM

The eggs in utero are soft, and vary in number from 50 to 300(2) (Plate 5, fig. 1). Extra-utero they are oval, faintly yellow, and double contoured, 83.5 by 62.5 μ, and have small lateral spines or thickenings, and at the opposite side caplike thickenings (Plate 5, fig. 3). In the opinion of Cort(7) the spines are variable and not of specific value. He noted that the surface of the shells of the eggs appeared to be covered with some sort of sticky substance and that the miracidia (larvæ) were motionless and completely filled the shells when examined fresh from the fæces; however, when placed in water the eggs begin to swell, leaving a considerable space between the miracidium and the shell filled with granules and oil globules extruded from the anterior ducts of the miracidium. The ciliated miracidium becomes active,

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often turning completely around; finally, the egg splits, freeing it. Cort believes that the splitting is not caused by the activity of the embryo, but the action of water, and quotes Smith as saying that the process of expansion takes place at about 30° C. in from ten to twenty hours.

Miyura and Sudzuki (29) demonstrated that the free-swimming animalcule penetrates its intermediate host, *Blanfordia nosophora* (a kind of sharply conical, dark gray snail, with a dextral opening and with seven or eight coils), by dissolving its cuticle and neutralizing the secretions of the host with the secretion of its own cephalic glands. Once it has gained entrance, it makes its way to the gills and wall of the alimentary canal where in twelve days the first radiæ appear. Gradually these concentrate in the bile ducts, where they grow and form secondary radiæ, or the sporocysts of Leiper. When fully developed the cercariæ escape from the snail and penetrate the skin of the vertebrate host (which in his case were mice), causing the disease schistosomiasis.

The anatomical structure and locomotion of both miracidium and cercaria are splendidly described by Cort. (6) The mode of penetration through the skin is described by him as follows: The cercaria takes hold with the ventral sucker and, by extending its body and by butting with the spines of the tips arranged around the openings of the ducts of the cephalic glands, produces a slight opening. Aided by the cytolytic and neutralizing secretions of these glands, and by the backward-pointing spines, the cercaria is able to penetrate the host. Once inside, the cephalic glands and the tail degenerate. At this stage, the sexes cannot be distinguished.

Miyagawa and Takemoto (28) trace the worms making their way into the lymphatic spaces; for the most part they invade the blood capillaries or the small peripheral veins, later accumulating in the right side of the heart. From the skin they may pass through the lymph vessels to the lymphatic glands in which many are arrested and killed. The worms that enter into the peripheral veins reach the right side of the heart and pass directly to the lungs, where they are arrested for a short time because of their size. Finally, they return to the left side of the heart, pass into the aorta, and are distributed to the gastrointestinal canal and from here to the liver through the mesenteric veins, or else directly from the aorta into the liver by the hepatic artery. The latter route would place the worms

in the arterial channels of the gastrointestinal tract as well as in the venous side, which is in accord with the findings of Phalen and Nichols(31) and of Catto.

The adult male is flat, 9 to 12 millimeters in length by 0.5 millimeter in breadth. The female is 12 to 26 millimeters in length by 0.4 millimeter in breadth, according to Manson.(24) Fantham, Stephens, and Theobald(13) give as extreme limits 5 to 22.5 millimeters and, for the female, up to 26 millimeters.

The adult males, obtained from autopsy 9132, measure from 6 to 9 millimeters (Plate 5, fig. 2), and one of the females measures 20 millimeters (Plate 5, fig. 1). The females are longer and thinner than the males. The middle portion of the female is thicker than the anterior or the posterior, and the surface is smooth. The oral sucker is smaller than the ventral, and both are armed with fine spines. The uterine canal is straight, commences as a little pouch about the middle of the body, and ends in a point below the ventral sucker. The ova at this place are in pairs and have their long axes parallel to the long axis of the uterine canal. There is a slight constriction of the canal between the four pairs of ova so that they look like coffee beans, as they are flat on the line of apposition. The next ova have their long axes diagonal to the axis of the canal. Below them there is a slight constriction of the canal and the portion posterior to this is more dilated than that above or anterior to it. The ova in this dilated portion look larger, have their long axes either parallel or diagonal to the axis of the canal, and lower down they are in twos or threes, and in various positions. About the middle of the body or a little below, the elliptical ovary is well marked with its pointed end anterior. The large end is posterior and from this a tube winds upward to join the end of the uterus. Another tube, which is thicker than the one mentioned, runs downward into the branched vitellarium. The junction of these tubes with the uterus is partly covered from view by the clear racemose shell gland. The habitat of the worms, according to Manson,(24) is the smaller mesenteric blood vessels, especially those draining the large intestine. Immature ones may be present in the portal and splenic veins, also in the gastric veins and in the coats of the small intestines, and even in the coronary veins of the heart. In this series, the adults were found in the portal vein of the liver in the first case, and in the tenth case in the portal vein and in the branches of the splenic vein.

DEPOSITION OF EGGS

Letulle(21) says that the worms migrate to the smaller veins; on account of the larger size of the male, he is left behind, while the female continues her migration until she comes to a small vessel, which she blocks, causing stasis of the vessel. Attaching herself to the intima of the vessel she evacuates her ova, the spines of which, aided by the pressure of the blood, are enabled to pierce the walls of the vessels, and the whole mass of ova is forced into the perivascular tissue.

Fairly(11) examined fresh pieces of bowel infected with *Bilharzia hæmatobia* [*Schistosoma hæmatobium*] and describes the process as follows:

> When the time for oviposition arrives the paired worms travel against the direction of the blood stream to the furthermost possible point. Hence the female leaves the male partner and being of a much narrower calibre, works her way into veins of small diameter, distending them in the process and only stopping when the mechanical resistance is too great for further progress. Here she deposits an ovum always in a characteristic fashion, the spine being directed posteriorly. The reason for this is that the ovum lies in a similar position in the uterus of the female. The female then slightly withdraws. *Pari passu* the distended vessel wall contracts down on the ovum. Again the female deposits an egg and withdraws, and again the vessel wall contracts down on the foreign body. In *Bilharzia hæmatobia* infestation many eggs are deposited in this fashion, so that microscopically the venule, with its contained ova, presents the appearance of a string of sausages. Probably local vascular spasm is a big factor in the production of this picture. When the female finally withdraws from the branched venule the blood current, which has in the meantime been held up, assumes its normal course, driving the ova before it. The spines which point in the direction of the blood stream, and are in close apposition with the walls of the venule, naturally pierce the latter structure and are then driven into the perivascular tissue.

Whether the worms of *Schistosoma japonicum* are found in the venous or in the arterial side, it seems to me that the female worm, by blocking the smallest arteriole, or venule, causes an anæmia. After depositing an egg or a mass of eggs she withdraws, and the blood rushes in and drives one or many ova through the wall of the vessel which has been weakened by the temporary anæmia and probably by the secretion of the contained miracidium or by some secretion from the mother discharged with the ova. In this way, the ova pass into the perivascular area. Once in the stroma of the intestinal mucosa, either the ova are expelled into the intestinal canal by the contractions of the intestinal wall or they cause necrosis and an inflammatory reaction; and, by the rupture of the small ab-

scesses thus formed, the ova are discharged into the lumen of the intestinal canal or into the peritoneal cavity.

Lanning,(18) from an examination of pathological slides, thinks that a mass of ova collects in the lymphatics of the intestinal submucosa, which causes pressure necrosis of the surrounding tissue, and so the mass of eggs is extruded into the bowel lumen. This accounts for the fact that ova are very often not found in the stools for a long period of time and, again, will be discovered in a small quantity of blood and mucus in large numbers.

REACTION OF THE DEFINITIVE HOST

Local necrosis is produced either by the toxic substance secreted by the contained miracidium in the ovum or by the pressure of the ovum or ova. The toxin plus the necrotic substances probably exert a chemotactic influence on the endothelium leucocytes, on the eosinophile leucocytes, plasma cells, lymphocytes, and fibroblasts. An isolated ovum is usually encircled by foreign-body giant cells, and in many instances one cannot but believe that these giant cells are formed by the coalescence of endothelial leucocytes. Sometimes the ovum is completely dissolved by these cells, as demonstrated by the pieces of transparent shell in their cytoplasm (Plate 3, fig. 1). In case the injury is severe and one or two foreign-body giant cells are not sufficient to counteract the injurious agents, then the lesion produced, as well as the tissue reaction, is similar to the infective granulomata. In the periphery of the eosin-stained necrotic center are epithelioid cells, giant cells, fibroblasts, and eosinophile leucocytes. They are inwrapped by circularly arranged fibroblasts and eosinophiles which merge into the outermost zone of fibrous tissue, eosinophiles, and small lymphocytes.

Should the nodule be located near a mucous surface, secondary pyogenic infection may take place and the nodule may either ulcerate or perforate, as in autopsy 4676, where a generalized suppurative peritonitis was apparently caused by the presence of masses of ova in all the coats of the appendix. In many instances an ovum or a mass of ova becomes encapsulated by fibrous tissue and eosinophiles and undergoes calcification. In the long run the outcome of this type of lesion is marked fibrosis.

Fairly,(12) in his investigation of immunity reactions in Egyptian bilharziasis, found that the cellular reaction is charac-

terized by eosinophilic leucocytosis and a corresponding increase in eosinophilic myelocytes in the bone marrow. This eosinophilic leucocytosis is well demonstrated in the cases reported, except in the cases of typhoid fever, in which the lesions indicate that the infection of *Schistosoma japonicum* preceded that of typhoid, as demonstrated by the encapsulated eggs, and suggest that the typhoid anaphylatoxin (Friedberger, 14) exerts a negative chemotaxis, not only toward the neutrophiles, but also toward the eosinophilic leucocytes.

HUMORAL REACTION

The researches of Fairly(11) on the complement-deviation reaction in bilharziasis by using an alcoholic saline soluble extract of the livers of infected snails of the species *Planorbis boissyi,* which is the intermediate host of *Schistosoma hæmatobium,* showed that the higher the eosinophilia the greater the amount of complement fixed, although some without eosinophilia also yielded positive reactions. He emphasized the fact that this serological phenomenon is of the nature of a group reaction, and does not enable one to differentiate the members of the species. In investigating the serological response in experimentally infected monkeys, he found that monkeys could be killed by hyperinfection before there was time for ova to be deposited in their tissues. The animals died either before there was time for an immunity response to develop or, if they survived longer, the intensity of the toxæmia often caused a complete depression of the mechanism of immunization. In all monkeys recovering spontaneously from the disease a remarkable cellulohumoral reaction was present. In every case there was positive complement deviation, and the bone marrow showed marked increase in eosinophilic myelocytes and also cellular proliferation and increase in the normoblastic tissue.

CLINICAL SYMPTOMS

In view of the fact that the number of cases reported in this paper seems to indicate that the infection is not altogether foreign to these Islands, a review of the clinical symptoms as described by other writers will be of some profit to our practitioners.

Lanning(18) divides his cases into three stages: The initial stage, marked by high afternoon temperature lasting from three to six weeks, comparatively slow pulse rate, evanescent

œdemas and urticarias, pains in the abdomen, generally in the upper part, cough with evanescent areas of pulmonary dullness, diarrhœa or constipation, marked eosinophilia, and often mental depression. The second stage is marked by enlarged liver and spleen, with a heavy feeling in the upper abdomen, marked eosinophilia and some anæmia, loss of weight, slight degree of fever at some particular time of day, passage of blood-streaked mucus containing the ova in the stools, more or less tenesmus and straining at stool, sometimes diarrhœa or constipation. A man generally gets better after several weeks or months in this stage, but may go on to the terminal stage after from three to five years, especially if reinfected several times. The terminal, or third, stage is marked by cirrhotic liver, sometimes enlarged, sometimes shrunken, ascites, œdematous extremities, marked emaciation, anæmia, weakness, passage of blood and mucus in the stools, and sometimes a little fever. The man may die of exhaustion or of some terminal infection.

As the ova do not appear in the stool much before the third week, the diagnosis in the first-invasion stage rests largely on the probability of exposure, the typical rash, the high evening temperature with attendant constitutional symptoms, the morning feeling of comparative well-being, and, last but perhaps more important and constant, eosinophilia. The ova may appear in the stool once, and not again for a comparatively long period of time. The incubation period, according to Lanning, is about twelve days.

Houghton,(17) in his notes on infection with *Schistosoma japonicum,* classifies the clinical symptoms as follows:

(*a*) Typical cases with enlarged liver and spleen, hydroperitoneum, and blood stools, 40 per cent.

(*b*) Cases showing only splenic enlargement with or without blood in the stools, 27 per cent. The eosinophilia in these cases will differentiate them from malarial cachexia or other condition.

(*c*) Cases with cerebral symptoms and a high grade of eosinophilia. He says that the cerebral lesion of his only case does not prove its connection with the flukes, but Tsunoda has recorded a brain involvement and thinks it is conceivable that a high pyrexia might stimulate the passing of great numbers of ova into the blood stream, to be swept outward and lodged as emboli elsewhere.

(*d*) Cases negative, except for marked eosinophilia, 25 per cent. The discovery of the trematode infection was incidental in these cases, and these make bad surgical risks, for the relative increase of eosinophile cells is at the expense of the polynuclear neutrophiles, presumably diminishing the power of this bodily defense against bacterial invasion.

(*e*) Latent cases, showing ova in the stools, but no bodily reaction, 5 per cent. One case gave a history of recurrent dysenteric seizures. The most important points clinically, according to Houghton, are:

1. The presence of ova in the stools. Not always easy to show.
2. A high grade of eosinophilia, ranging from 10 per cent to 50 per cent.
3. Greatly exaggerated knee jerks, which occur in practically every case.
4. Lack of anæmia. The average hæmoglobin index was 80 per cent, but there is a peculiar muddiness of complexion that often suggests anæmia.
5. Lack of leucocytosis.[2] Unless complicated by some purulent process, the leucocytes remain at or below normal.
6. Emaciation, not to be accounted for in other ways, is occasionally a feature.

To this classification Bovaird and Cecil(1) add the terminal cases characterized by portal obstruction, advanced anæmia, and death by exhaustion. They believe that the ascites is due to liver cirrhosis, endophlebitis, and thrombosis of the portal vein by the ova.

The experience of Houghton(17) in examining stools for ova is worth mentioning, for these may be more readily mistaken for *Ascaris lumbricoides* than for *Ankylostomum* eggs. When the mammillary envelope of *Ascaris* egg is not deeply bile-stained and the bosses are not prominent, the two may be difficult to distinguish. The novice would be likely to mistake a *Schistosoma* ovum for such an *Ascaris* egg, and neglect to turn on the high power.

REPORT OF CASES

Infection with *Schistosoma japonicum* has been reported from the Philippine Islands.

Wooley in 1906(35) described the autopsy findings in a native Filipino who had not been out of the Islands and who at the time of death was a prisoner in Bilibid. This investigator foretold that other cases would be found here.

Heiser in 1908(16) reported fifteen cases from the inmates of Bilibid Prison.

In the same year Garrison(15) reported the result of a statistical investigation conducted during the year 1907 among 4,106 prisoners from all parts of the Islands, including a number of Chinese and a few Americans in Bilibid Prison. *Schistosoma*

[2] The studies of Chamberlain, Am. Journ. Trop. Dis. and Prev. Med. 2 (1914) 41, on blood of Filipinos, showed an absolute reduction in efficient phagocysts. In the unpublished studies of Leach, Ash, and Haughwout the polymorphonuclear counts vary from 34 to 65 per cent, and are mainly below 60 per cent.—M. P. M. G.

japonicum occurred only among Filipinos and on an average of 0.4 per cent. Excepting one case from Manila, all infections appear to have originated on the three southern islands; namely, Samar, 6 cases; Leyte, 5; and Mindanao, 4.

Phalen and Nichols(31) in the same year (1908) published the record of a case, a native of Calbayog, Samar, who had lived continuously in that town until his twenty-fourth year. He then enlisted in the Philippine Scouts and, during the six years of his service, was stationed on Panay, Cebu, Leyte, and Samar, and came to Manila for short visits only.

In 1909 Strong,(33) in his medical survey of the town of Taytay, Rizal Province, Luzon, mentions a case of dysentery caused by *Schistosoma japonicum* which was not contracted in Taytay, and states that *S. hæmatobium* had only been found in Manila in instances where the infection had originated in foreign countries.

Crowell and Hammack in 1913(9) mention a case of *Schistosoma japonicum* in a Filipino, 18 years old, observed in the laboratory of the College of Medicine and Surgery, University of the Philippines, by Dr. V. L. Andrews. A detailed report of this case will constitute the first of the series discussed in the present paper.

In 1914 Willets(34) found three cases among 7,843 prisoners examined upon admission to Bilibid Prison. These cases came from Manila, Leyte, and La Union.

P. Guazon reported to the Manila Medical Society in 1918 a case of chronic obliterative appendicitis in a young man, 22 years old, who was a resident of Quiapo, Manila, at the time of operation. Histological sections of the appendix showed complete obliteration of the lumen and the presence of ova of *Schistosoma japonicum* situated singly and in groups in its wall.

The ten cases reported in this paper were autopsied in the morgue of the College of Medicine and Surgery, University of the Philippines, which is, at the same time, the City Morgue of Manila, and the autopsies were performed by the members of the staff of the department of pathology and bacteriology.

FIRST CASE

Clinical history.—F. B., Filipino male, 18 years old, residing in Paco, Manila, complained of restlessness and difficulty of breathing. No history could be taken, for patient refused to talk. Admitted to the Philippine General Hospital, December 23, 1912.

After a few hours in the hospital the patient died, with the diagnosis of mitral stenosis and acute passive congestion of the liver. The necropsy was performed, nine hours after death, by Dr. V. L. Andrews.

Morbid anatomy.—Autopsy 2191. Body is that of a well-nourished and well-developed muscular Filipino. Considerable increase of clear yellowish fluid in the peritoneal cavity. The sigmoid shows the presence of three large and hard nodules, measuring from 2.5 to 3 centimeters in diameter, attached to its serous coat in the line of the appendices epiploicæ (Plate 1, fig. 1). The intestinal wall at this portion is thickened. The lymph nodes in the mesocolon opposite these tumors are slightly enlarged but not extraordinarily so. As the palpating finger passes over them they feel like small grains of sand or miliary tubercles. The appendix is 11 centimeters long; it is free except for the attachment of its mesocolon, which is rather prominent. Two centimeters from its beginning there is a slight stricture in the appendix; at its distal point it is enlarged, measuring 1.3 centimeters in diameter; it is rather firmer than normal. Five centimeters from its distal end there is another enlargement which measures 1.5 centimeters in diameter. This is also firm, and corresponds in feeling and appearance to the nodules that were found on the sigmoid. The liver is roughened and rather firmly attached by adhesions to the undersurface of the diaphragm.

Pericardial sac shows an increase of a greenish yellow fluid which contains a few flocculi. The right side of the heart is considerably dilated and hypertrophied.

The left lung is bound by numerous fibrous adhesions to the parietal wall, practically obliterating the pleural cavity. Parietal pleura is much thickened. The lung is light purple, crepitant for the most part, but there are a few nodules present; these are in the anterior portion of the lower lobe and lower anterior portion of the upper lobe. The two lobes are bound together by firm adhesions. The nodules that were noticed are on the surface, and the visceral pleura covering them has a mottled, yellowish appearance. Section through the nodules shows a yellowish gray appearance but apparently no increase of fibrous tissue. Another section through the nodule reveals yellowish gray areas, apparently of necrosis. These are irregular in outline, most of them communicating with the surface, but some are deeper in the tissues. The edges of these gray nodules are yellower than the central portion. Section through the lung substance shows a peculiar mottling of dark red lung tissue with darker hæmorrhagic areas scattered here and there. Considerable increase of fluid is present in the right pleural cavity. One small nodule was encountered in the central portion of the upper lobe of the right lung.

Spleen is bound by adhesions to the abdominal wall and diaphragm and is removed with difficulty.

Liver measures 2.5 by 17 by 9.5 centimeters. Liver surface is very rough, covered by numerous tags and adhesions which contain considerable œdematous fluid (Plate 1, fig. 2). The edges of the liver are rounding. Where adhesions are not present, the liver is dark brown. Capsule is thickened. The liver oozes considerable blood. The cut surface is moist and firm, and a few old scar formations are present in its substance (Plate 2). Most of these are darker than the surrounding tissue. A few pinpoint, grayish white areas are scattered through the liver substance. The lobulation of the liver is not clearly defined. Liver weighs 1,617 grams.

Urinary bladder contains some turbid urine. Mucosa normal.

Rectum.—The lower part shows the presence of a few hæmorrhagic areas and one internal hæmorrhoid measuring about 0.7 centimeter in diameter.

Intestines.—The wall of the ileum is somewhat thickened, especially the serous coat. A large number of *Trichuris* worms are present in the cæcum. The appendix shows a definite thickening of the appendicular walls at the two enlargements noted in the description of the peritoneum. It is cut with considerable resistance and is almost fibrous, but the cut surface is rather dry and does not appear to be very fibrous. The mucosa at this point seems to be intact but is dark colored. Lumen is patent. In the cæcum there are one or two small enlargements of the mucosa. These appear to be in the mucous coat proper. No ulcerations. Beginning with the lower part of the descending colon (Plate 1, fig. 3), extending through the sigmoid and into the rectum, there are numerous small enlargements of the mucosa extending into the lumen of the gut. These are very irregular in outline and in size, measuring from 3 millimeters to 1 centimeter in diameter; most of them seem to be confined to the mucous membrane, looking more like mucous polyps; some, however, are attached to the muscular layer by firm adhesions. Section through the nodules noticed on the external surface of the lower part of the sigmoid shows a definite tumor formation—bands of connective tissue between which cellular tissue is present. It is attached to the serous coat of the intestine.

Lymph nodes.—The lymph nodes in the mediastinum are all enlarged and somewhat œdematous. Retroperitoneal lymph nodes over the lumbar vertebræ and up as far as the cœliac axis are all enlarged; some of them are somewhat œdematous, others in the mesocolon of the sigmoid are slightly enlarged and very firm. In sectioning through them, the knife meets with considerable resistance, almost as though it were calcareous material, and in some considerable yellowish necrotic material is present. The lymph nodes surrounding the bile ducts and the pyloric end of the stomach are enlarged. On section these are very cellular, moist, and glistening. The mesenteric lymph nodes are enlarged and show on section marked hyperæmia.

HISTOPATHOLOGY

Lung.—With the lower power, the section shows areas of partial atelectasis and emphysema, and marked congestion of the blood vessels and capillaries. The bronchioles show desquamation of epithelium and congested wall. Irregularly disseminated in the field are various nodules in different stages of formation, which at first sight look very much like miliary tubercles. On close inspection, however, one sees that the giant cells are of foreign type and many either are trying to envelop an ovum or contain yellow transparent pieces of shells. Another feature is the presence of eosinophiles in the fibrous tissue wall (Plate 3, fig. 2).

Another nodule (Plate 3, fig. 1) shows central necrosis and a zone of radiating epithelioid cells with a large foreign-body giant cell at one side, toward which many of the epithelioid cells around it are directed. At the periphery of this zone of epithelioid cells are many foreign-body giant cells, which seem to be formed by their coalescence. The next zone is formed by circular fibroblasts and eosinophiles and merges with the outermost zone composed of fibrous tissues, eosinophiles, and small lymphocytes.

Another large nodule is seen with a central area of necrosis in which one can see some well-stained eosinophiles. In the periphery of this there are radial epithelioid cells, eosinophiles, large foreign-body giant cells, and a piece of yellow shell. These are all encapsulated also by concentric layers of fibroblasts, in which eosinophiles, a few plasma cells, and small lymphocytes are found, in the order named from the center outward. The lung tissue under high power shows marked hæmorrhage by diapedesis and marked eosinophilia in the neighborhood of the nodules.

Large areas of necrosis are also found on section of the lungs. The necrotic center is eosin stained and is composed of different kinds of cells undergoing degeneration. No trace of the framework is seen in it. This is also encapsulated by a few epithelioid cells, giant cells, fibroblasts, fibrous tissue, plasma cells, and eosinophiles. In this fibrous capsule there are calcified ova, which are walled off by fibroblasts, plasma cells, and eosinophiles. The lung tissue around these necrotic areas is atelectatic with much fibrosis, and contains many eosinophiles.

The nodules are located in the lung tissue, singly or conglomerated; a few are near the large blood vessel, but none was found in the wall of the bronchi, bronchioles, or blood vessels.

The eggs occur singly or in groups of three, and the highest number was seven. None is seen in the interlobular septa, pleura, or wall of blood vessels and bronchi.

An isolated egg is sometimes found in a septum, and the cells next to the egg stain pink, are granular, and have no nuclei. The shells of the ova are yellowish and transparent, with a thick border, or rim. They are usually wrinkled, but in the shells of those that are distended no spines can be detected or recognized; when these are seen the cytoplasm is opaque, eosin stained, and globular, or slightly oval. Eccentrically placed is a group of minute blue-stained chromatin bodies. This arrangement is probably due to the angle at which the egg is sectioned, for in many ova the chromatin bodies are centrally placed. Many of the isolated ova are accompanied by single foreign-body giant cells which have the tendency to encircle the ova and dissolve them.

The egg in the histological sections measures 80 by 38 microns.

Liver.—Single and conglomerate nodules with single ova or groups of ova are found in the interlobular and intralobular septa. Many of the ova are calcified, and a few nodules have undergone hyaline transformation. The sinusoids are filled with blood, and the liver cells are smaller than normal and show fatty degeneration. In one of the sections of the portal vein a cross section of an adult worm is present (Plate 4, fig. 2); this is flat and thin, with margins turned ventrally inward, one being deeper than the other. About the middle there are two small ductlike openings (Plate 4, fig. 1).

Colon.—The submucosa is thicker than normal, due to a dense deposit of ova, eosinophiles, and fibroblasts. Areas of necrosis similar to those found in the lung are also present in the submucosa. Almost all the ova are calcified. The mucosa shows catarrhal desquamation, marked infiltration of eosinophiles, and few ova in the stroma. The muscularis is free from ova. The polypoid growth of the serosa is made up of fibrous tissue, fibroblasts, eosinophiles, groups of ova, round-cell infiltration, and areas of necrosis.

Mesenteric lymph nodes.—Groups of ova are found in the border line of the cortex and medulla, encapsulated by fibrous tissue with few eosinophiles. Isolated ova are also found outside the capsule without any sign of reaction around them. Another group of ova is also present in the medulla with giant cells and without any capsule. The sinuses are dilated and filled with lymphocytes and eosinophiles. Other sections of mesenteric lymph nodes are completely packed with eggs, especially the medullary portion. Many of the follicles are intact, but others contain ova; even the capsule is not free from them.

Peribronchial lymph nodes.—Eosinophilic infiltration.

Heart.—Eosinophilic infiltration in the septa, and congestion.

Spleen.—Congestion and fibrosis.

Kidney, testes, pancreas, and prostate are free from ova and do not have eosinophilic infiltration. Sections stained by Willyoung's method (35) show brilliant red ova and clear blue tissue.

ANATOMIC DIAGNOSIS

Acute dilatation and hypertrophy of right heart; acute dilatation of left heart; chronic myocarditis; hydropericardium; chronic endocarditis; congestion of lungs with slight hæmorrhages; chronic obliterative pleurisy, left; hydrothorax, right; necrotic nodules, two, left; chronic passive congestion of spleen; chronic perihepatitis; chronic passive congestion of kidneys; chronic perisplenitis; cirrhosis of the liver; mucous tumors of sigmoid; tumor in appendix; ascites; acute lymphadenitis, retroperitoneal, mesenteric, and cœliac axis; œdema of mediastinum; congestion of meninges and brain substance; uncinariasis trichocephaliasis; ascariasis; schistosomiasis.

In this case we have an adult worm in the portal vein of the liver, ova in the liver, mesenteric lymph nodes, and colon, with eosinophilic infiltration in these organs and in the peribronchial lymph nodes and heart. There is absence of ova and eosinophilia in the kidneys, testes, prostate, pancreas, and spleen. The gross pathological anatomy is that of a terminal case of infection with *Schistosoma japonicum*.

SECOND CASE

F. V., Filipino male, 18 years old, residing in Tondo, Manila, died of electrocution on June 12, 1914.

Morbid anatomy.—Autopsy 3241. Body is that of an adult, male Filipino, 150 centimeters in length and weighing 43.49 kilograms. On the anterior aspect of the thorax there is a large gaping wound, which extends completely across the thorax and through its entire depth as far posteriorly as the vertebral column, completely severing all structures. The pleuræ are firmly adherent to the thoracic wall and diaphragm.

Intestines.—Some of the epiploic appendices are firm and pale. In the ileum there is marked prominence of the lymphoid tissue, which is pale. In the cæcum and extending throughout the entire colon there are numerous groups of nodules, which are small, discrete, conglomerate, elevated, conical, with for the most part umbilicated centers. These form irregular

groups, the individuals of which are blackish and greenish. There are also three or four polypoid rounded excrescences of the mucosa in the colon. Between these the mucosa is apparently slightly thickened and there are other rounded pale elevations which apparently represent nodules beneath the mucosa. The mesocolic, mesenteric, and retroperitoneal glands are slightly enlarged; they are firm and yellowish gray. The vermiform appendix is somewhat dilated tortuous and has surrounding adhesions causing its distortion. Minute dissection of the mesentery, mesocolon, and mesenteric and mesocolic glands fails to reveal the presence of any parasites visible to the naked eye.

Liver is rather small and is surrounded by firm adhesions binding it to the diaphragm. In the middle of the anterior surface of the left lobe is a rather deep incisure with rounded margin, the base of which is formed by fibrous tissue. The organ is firm, the capsule thickened, and the surface nodular and yellowish brown. The nodules vary from a few millimeters to several centimeters in diameter. The depressions between them are not deep. On section the liver is firm and cuts with considerable difficulty. The cut surface is yellowish brown, and the liver lobules are not distinct. There are large thick strands of fibrous tissue scattered irregularly throughout the organ, and in the parenchyma are fairly soft yellowish areas which are not elevated, averaging from 3 to 5 millimeters in greatest diameter. These are very numerous and widely scattered throughout the organ. There is some pale firm tissue about the branches of the portal vessels within the liver. No parasite is found in the intrahepatic vessels or bile ducts. Liver weighs 1,195 grams.

NOTE.—Scrapings from the nodules in the large intestine contain eggs of *Schistosoma*, apparently *japonicum*.

ANATOMIC DIAGNOSIS

Electrical burn of thorax, arms, thigh, heart, lungs, aorta, and vertebræ; chronic polypoid colitis; schistosomiasis; chronic interstitial hepatitis (schistosomiasis); chronic perihepatitis; congestion of stomach and duodenum; chronic lymphadenitis (mesenteric, mesocolic, and retroperitoneal); fatty degeneration of kidneys.

NOTE.—The liver shows portal cirrhosis and the presence of ova.

THIRD CASE

Clinical history.—J. A., male Filipino, 23 years of age, single, born in Samar, now residing in Manila, complained of fever and headache. Date of admission to the Philippine General Hospital, July 9, 1915.

Present illness.—Five days ago had headache, coldness of the body, and chill followed by fever. He did not have any pain in the joints nor cough. The chill appeared again and recurred two or three times daily. He was constipated for about four days.

Physical examination.—Slight dyspnea, no cyanosis. The circulatory and respiratory systems are apparently normal. The pulse is small and frequent, but regular. The lower border of the spleen is one finger below the costal margin. Sensorium is clear; knee jerks are diminished.

July 9, 1915.—Convulsions in the upper extremities and eyes staring upward. Neck is rigid, Kernig's sign is positive. Pulse is filiform. No fluid comes out from the lumbar puncture. Temperature is 40 to 41° C.

Laboratory examination.—Urine shows decided trace of albumen and abundant red blood cells. The white count is 8,600, with 49 per cent poly-

nuclears, 31 per cent transitionals, 11 per cent small lymphocytes, 7 per cent large lymphocytes, 1 per cent eosinophiles, and 1 per cent mast cells. Smears from the blood are negative for all types of malaria. Widal reaction is negative.

Clinical diagnosis.—Malaria, cerebral type, and meningitis.

Morbid anatomy.—Autopsy 4087. Body of a poorly nourished, adult, Filipino male. The abdominal cavity itself is dry and sticky. The appendix is retrocæcal, extends almost to the liver, and is bound by fibrous adhesions. The colon is considerably enlarged; it fills the entire pelvis, and the loops are adherent to each other and to the surrounding tissue and bladder by means of a sticky sero-fibrinous material. The appendices epiploicæ upon the colon are considerably enlarged and in some places matted together. Abdominal viscera lie in normal relationship to each other. The right pleural sac contains some adhesions posteriorly.

Intestines.—The entire wall of the colon is considerably thickened and somewhat firm in consistency. The mucosa of the colon appears to be thickened and in the rectum has a bluish red tinge, is somewhat elevated in slight nodular masses which are of a somewhat polypoid appearance, while throughout the remaining portion of the colon the mucosa is thrown into very prominent rugæ and has a pale color with areas of pinkness, is moist, and shows no further growth or change. The appendix is thickened, rather firm in consistency, and considerably elongated. The mucosa of the ileum is altered over the lower 1.5 to 2 meters. Covering this area there are about fifteen Peyer's patches which are elevated from 3 to 5 millimeters above the surrounding mucosa, and much of the solitary lymphoid tissue over this part of the intestine is elevated likewise.

The lymph nodes throughout the mesentery are much enlarged; the largest measures about 4 centimeters in diameter. All of these glands are dark bluish externally, and on section show a pale pinkish surface which bulges, and on some of the cut surfaces there are smooth, deep red areas 2 to 3 millimeters in diameter from which blood-tinged fluid oozes.

Liver.—The common bile duct is patent. The liver itself weighs 1,677 grams; it is firm in consistency, the capsule is bluish gray, and the surface is somewhat roughened by pale, opaque, anastomosing bands of tissue, giving the surface a somewhat nodular appearance; there are also some depressed puckering scar areas, and beneath the capsule minute yellowish areas 1 to 2 millimeters in diameter are visible, which are diffused irregularly over the entire surface. Section into the liver shows it to be cut with some resistance; the cut surface is marked in many places with pale dense strands of tissue, and dark red areas which vary in size from a few millimeters to 1.5 centimeters, and diffused over the entire cut surface there are yellowish areas 1 to 2 millimeters in diameter. The lobules are faintly visible; some have a yellowish brown tint, others have a reddish color. There are also pale strands of tissue extending into the liver from the capsule.

Urinary bladder contains some amber-colored urine. The mucosa is pale and smooth.

HISTOPATHOLOGY

Liver shows focal areas of necrosis, typhoid; congestion; cloudy and fatty degeneration; portal cirrhosis, schistosomiasis. Nodules with well-formed clear or calcified ova, resembling those of autopsy 2191, are found in the interlobular septa and in the lobule containing foreign-body giant

cells, fibroblasts, fibrous tissue, and small lymphocytes, but no eosinophiles. Isolated ova are seen in the peripheral and intermediary zones of the liver lobule without any cellular or fixed tissue reaction around any one of these. Focal necrosis is present near the nodules located in the lobule, and in a few instances a single ovum is found in the area of necrosis showing signs of degeneration and disintegration.

Intestines.—Hyperplasia of the lymphoid follicles and ulcerative enteritis, typhoid. Groups of ova in the submucosa, muscularis mucosæ of the colon, without any fixed tissue or cellular reaction can be recognized. A slight coagulation necrosis only is present in the area occupied by the ova. As in the first case, isolated ova are lodged now and then in the stroma of the mucosa. Many are found around a lymphoid follicle, but in no instance is any found inside. Almost all the ova are well preserved, clear, not wrinkled, and in none is a spine detected. The muscular and serous coats are free from ova.

Mesenteric and hæmolymph nodes. Single ova and groups of ova are deposited in the medulla.

The other organs are free from ova and eosinophilic infiltration.

ANATOMIC DIAGNOSIS

Acute enteritis, acute splenitis, typhoid; fibrosis of the liver; polypoid colitis, schistosomiasis; ankylostomiasis; trichocephaliasis.

Sections show characteristic lesions of typhoid and the presence of ova in the liver, colon, mesenteric lymph node, and hæmolymph node, either singly or in groups without the presence of eosinophiles. Presence of calcified ova in the liver and old fibrous nodules indicates that the infection with *Schistosoma japonicum* took place before infection with typhoid. What is the cause of the disappearance of the eosinophiles in the field? The presence of ova without any tissue reaction suggests that they are freshly laid. The lesions are not so far advanced as in the first two cases.

FOURTH CASE

Clinical history.—Bureau of Prisons No. 33742, male, Filipino, 18 years old, laborer, single, born in Samar. Admitted to the Philippine General Hospital May 31, 1915, complaining of pain in the abdomen, and fever.

Had malaria at 11 years of age. He was seldom ill and only with occasional fevers. Had no smallpox nor dysentery.

A few hours after supper the previous night he felt acute pain in the abdomen which became generalized all over the hypogastrium. On account of this pain, he was given a purgative. His bowels moved at midnight, but the pain became worse. The pain and tenderness became intolerable. Next morning he was given an enema, but his condition became worse. His temperature became high, and he vomited several times. He was then taken to the Philippine General Hospital.

Patient is well developed and well nourished, feels nauseated and vomits greenish yellow fluid with food and mucus. The abdomen is as high as the thorax and is tympanitic. Rigidity is more marked in the lower half of the abdomen, and the tenderness is more marked in the hypogastrium.

Laboratory examination.—May 31, 1915. White count, 15,100; polynuclears, 88 per cent; small lymphocytes, 8 per cent; and transitionals, 4 per cent.

June 2.—High fever, delirious, pain persistent, relieved by ice cap. Tenderness marked in the right iliac region.

June 10.—Restless and weaker. White count is 38,200.

Clinical diagnosis.—Peritonitis, acute; appendiceal abscess.

Morbid anatomy.—Autopsy 4676.—An undersized male adult Filipino with sunken abdomen and rigid musculature. The peritoneal cavity contains about 3 liters of greenish creamy material; the coils of the intestines are adherent to each other, and the serosa presents a necrotic appearance. The omentum is thick, blue, cordlike, and attached to the right iliac region. On looking for the source of this suppurative process, the appendix is found elongated and retrocæcal, and 1.5 centimeters below its tip is an oval opening which has perforated all the walls of the appendix. The mesenteric lymph nodes are all enlarged and deep red. The peribronchial glands and bronchial glands are all enlarged and deep purple.

The spleen is enlarged, the capsule is pale bluish, and numerous fibrous tags are found attached to the wrinkled capsule.

The liver is covered with pus, especially the anterior surface and the dome. It cuts easily, and the cut surface is swollen, pinkish yellow, and pale. The lobulations are not distinct. The liver weighs 1,503 grams.

Stomach contains about 1 liter of dark green fluid. The mucosa and wall of the intestine are œdematous, but there is no ulcer anywhere. The ileocæcal valve is especially œdematous, and the opening is very small. On opening the appendix the wall of the proximal part is found to be 4 to 6 millimeters in thickness, and firm and hard; the mucosa is white and thick, but the distal part is gangrenous and, as noted before, an opening is found near the tip which is about 7 to 8 millimeters in diameter, having its longest axis parallel to that of the appendix.

HISTOPATHOLOGY

Liver.—Foreign giant cells containing shells enveloped by old fibrous tissue and small lymphocytes. Single ova and groups of ova in the portal and interlobular septa. Isolated ova in the periportal zone of the lobule. Capsule covered with fibrino-purulent exudate.

Intestines.—Groups of from 6 to 34 ova are found in the thickened submucosa, mostly below the muscularis mucosæ. In the muscularis they are enveloped with fibrous tissue, lymphocytes, and few eosinophiles. Serosa shows congestion, and fibroblast and many plasma cells, the capillaries are congested with red and polynuclear cells. The exudate is composed of fibrin and dead cells.

Appendix.—Groups of ova are found in all the coats. Signs of acute fibrino-purulent inflammation are also present.

The other organs are free from ova and eosinophilic infiltration.

ANATOMIC DIAGNOSIS

Acute fibrino-purulent peritonitis; perforation of the appendix; schistosomiasis; fibrosis of the spleen with enlargement; chronic interstitial nephritis; dilatation of the heart.

The abdominal pain complained of by this individual suggests that it was probably caused by the deposition of ova in the wall

of the ileocæcal valve. The administration of the purgative undoubtedly aided the intestinal contractions and the expulsion of the ova into the intestinal lumen and peritoneal cavity. Both processes weakened the intestinal wall, allowing in this way the intestinal bacteria to gain a foothold not only in the intestinal wall but also in the peritoneal cavity, either directly or through the lymphatics. This case and the one reported by Dr. P. Guazon place this infection as one of the etiological factors of appendicitis.

FIFTH CASE

B. M., male Filipino, 57 years old, residing in San Nicolas, Manila, died suddenly in the Luneta Police Station on February 5, 1918, due to severe hæmorrhage from the lungs.

Morbid anatomy.—Autopsy 5948. A fairly developed, but greatly emaciated, Filipino adult. The appendix is long, pointed toward the pelvic region, and there are some fibrous adhesions at the base. Fibrous adhesions bind the anterior surface of the liver to the diaphragm. The right lung is firmly adherent to the thoracic wall. The left lung is voluminous, grayish, and shows old scars in the middle of the upper lobe. Another scar is found below and anterior to it. There are also old scars in the lower lobe. Fibrous thickenings of the visceral pleura are found in the apex of the superior lobe of the right lung and also in the middle of the lower lobe. Firm nodules which seem to contain minute sandlike material are present in the anterior surface of the superior lobe. Section of the superior lobe of the left lung reveals a large cavity, just below the scar, containing caseated material. Around this cavity and in the septa of the lungs there are large, solid, fibrous bodies. Lower lobe shows a mottled appearance of swollen red lung tissue and fibrous tubercles, especially in the septa and around the bronchi. Right lung is firmly adherent to the thoracic wall, and is completely fibrous and covered by a thick pleura. A cavity, about 7 centimeters in diameter, is found in the apex of the superior lobe. This cavity has many fibrous cords running through it, and the wall is rugged and fibrous.

The spleen is small and pale purple.

The liver is small, soft, flabby, and pale, and the anterior surface is covered by fibrous tissue. The liver cuts easily, and the cut section is pale brownish, soft, and swollen. Liver weighs 1,520 grams.

Intestines contain yellowish, acid, fæcal material; otherwise, they are apparently normal.

HISTOPATHOLOGY

Liver.—In the peripheral zone of the lobule were seen isolated single ova, sometimes without any cellular reaction and sometimes with a giant cell around the ovum; in the portal areas or beneath the capsule of the liver were groups of ova, varying in number from two to fourteen, inclosed in a thin capsule of fibrous tissue that contained round cells and eosinophiles. Section of nodules contained fibroblasts, eosinophiles, and round-cell infiltration without any trace of ova. Fatty infiltration in the peripheral zone of the lobules, and congestion and dilatation of the portal veins are seen.

Lungs.—Groups of freshly laid ova in the wall of the cavity which is infiltrated with small lymphocytes, eosinophiles, giant cells, and polynuclear leucocytes. The lung tissue and wall of cavity contained a great number of acid-fast tubercle bacilli.

Spleen.—Marked fibrosis, eosinophilia, pigmentation, hyaline degeneration of the blood vessels, and minute tubercles which contained acid-fast bacilli.

ANATOMIC DIAGNOSIS

Anæmia, secondary; hæmorrhage, pulmonary; dilatation, heart; ulcerative and fibro-caseous tuberculosis, lungs; miliary tuberculosis, lungs and spleen; fibrosis, right pleura and Glisson's capsule; chronic interstitial nephritis; parenchymatous degeneration, heart, liver, and adrenals; schistosomiasis, liver and lung.

SIXTH CASE

S. M., 27 years of age, Filipino, laborer, residing in Ermita, Manila, was admitted to the Philippine General Hospital on February 5, 1919, complaining of severe headache, moderate fever, and chilly sensation. Last November he had influenza. He had cough, fever for fifteen days, but no chest pain. The attack was not severe according to the patient, yet after the febrile period he felt weak and had to stay in bed until last January. Since this attack he has been coughing. Two days before admission he had chills and headache. The duration of the chills was one and one-half hours, and afterward the headache was very severe. Patient states that he had frequent headaches before the present illness. He is able to sit up in bed, but cannot walk on account of his weakness.

His eyes react well, the right has poor vision; both are congested and watery. There is slight rigidity and also tenderness in the right mastoid region. The liver and spleen are not palpable. Kernig's sign is slightly positive, patellar reflexes are diminished, ankle clonus and Babinski's sign are absent. He is conscious and irritable.

February 11, 1919.—Patient tends to sleep; if asked the reason, he says that he feels well. At times he talks nonsense when asked if he is out of his mind.

February 12, 1921.—Patient was in good condition this morning, but at 1 o'clock this afternoon he had sudden tonic convulsions, and expired shortly after.

Laboratory examination.—Urine negative for albumen and sugar, rare hyaline casts, and few red blood cells.

The temperature was 39.5° C. on admission; it became subnormal in the early part of the mornings and rose to 38° C. in the afternoons.

Clinical diagnosis.—Influenza, with pneumonia and cardiac failure; uræmia?

Morbid anatomy.—Autopsy 6862. A well-developed, well-nourished Filipino male, adult. The left arm is more contracted than the right. The peritoneal cavity does not contain any fluid. Appendix is long and retrocæcal. Mesenteric lymphatic glands are enlarged and soft. The right pleural cavity is completely obliterated. The right lung is small, and the left is slightly voluminous. A triangular area in the anterior portion of the left upper lobe is held by fibrous adhesions to the thoracic wall. This portion is firm and fibrous and shows on section dilated bronchi and thick, fibrous tissue around each bronchus.

Chronic fibrous tubercles, some of which contain small amounts of calcareous material in the center, are present in the right lung. The bronchi contain much mucus, and the mucosa is congested. The peribronchial lymph nodes are slightly enlarged. The lymph nodes around the diaphragmatic arch are enlarged and yellowish.

The spleen is very small, wrinkled, and dark blue; it weighs 85 grams.

The liver is larger than normal; it is dark blue and mottled with minute pearllike dots. These are definitely circumscribed and vary in color from bluish opalescent to opaque pale yellow. The liver cuts easily, and the cut section shows some areas of hæmorrhages. The liver tissue is friable, soft, and dark blue; the lobules are not distinct. The liver weighs 1,390 grams.

Alimentary system shows marked congestion and the presence of ascaris, trichuris, and ankylostoma; otherwise it is apparently normal.

Brain.—On removing the dura the brain presents an opaque, swollen, uniform grayish yellow tissue with very shallow sulci. On removing the brain from the skull a small puncture was made into the right temporal lobe from which a thick greenish fluid came out. This fluid has no odor and contains large green clumps. The brain has a more-dilated right hemisphere, and on section through it the temporal lobe shows a greenish purulent material and necrotic brain tissue. The peduncle of this side is also swollen and opaque, and there are many petechial hæmorrhages in it. The left petrous bone is congested, but the right contains necrotic material. A careful examination shows that the right ear has a slight discharge. Smears from the exudate show many streptococci and long fine bacillary forms. Cultures were found positive for streptococci and *Bacillus influenzæ*.

Histological sections from the intestines and mesenteric lymph nodes were not taken.

HISTOPATHOLOGY

Liver.—Congestion and numerous nodules of different sizes containing ova.

Lung.—Large areas of necrosis, similar to those of the first case, containing dead and well-preserved foreign-body giant cells, catarrhal cells, plasma cells, eosinophiles, and round-cell infiltration, walled off by granular tissue where cells of the same type can be recognized. Sections stained for acid-fast bacilli are negative. No ova, however, can be seen in the sections. The triangular area in the left lung shows marked fibrosis in the interlobular septa, in the wall of the bronchioles, and in the alveolar septa near these structures.

Brain.—Polynuclear-cell infiltration in the swollen walls of the congested capillaries. Section of the large area of necrosis shows a wall similar to that found in the lung. No ovum is seen in the section.

ANATOMIC DIAGNOSIS

Abscess, brain; dilatation of the heart; bronchiectasis and interstitial pneumonia, local, lung; chronic adhesive pleurisy; schistosomiasis.

It has been mentioned before that hyperpyrexia may favor the dissemination of ova. Is the necrosis in the brain and in the lung of this case caused by emboli of ova which became infected afterward with pyogenic microöganisms? Are these

purely bacterial in origin? Fibrosis of the lungs is a common finding after influenza,(26) yet the presence of giant cells and eosinophiles indicates that the injurious agent which attracted them is not far away.

SEVENTH CASE

Clinical history.—T. A., 22 years of age, single, Filipino sailor, residing in Binondo, Manila; admitted to the hospital on June 30, 1921, complaining of fever, headache, and abdominal discomfort. The fever was of eight days' duration; continuous and moderate in degree. Since the onset of the disease patient has had no desire for food; he suffers from constipation at times, alternating with diarrhœa. Patient is complaining of pain in the chest. He does not cough. On physical examination dullness is noted and crepitant râles heard in the base of the right lung. Similar râles are heard in the left interscapular region. Heart beats fast, without murmurs. Abdomen is distended and flatulent.

July 2, 1921.—Patient is delirious. Abdomen is distended and tympanitic. Marked dullness at the right base with few occasional râles. Heart beats are fast, pulse is soft. At noon he passed a slightly coffee-colored bloody stool.

July 3, 1921.—Adbomen tympanitic and slightly rigid. Marked tenderness in the right iliac region. At 3 p. m. had profuse bleeding from the gums. Bladder is distended.

July 5, 1921.—Unconscious; respiration rapid and deep. Heart is galloping, but heart sounds are distinct and free from murmurs. Rhythm normal.

Abdominal examination reveals nothing.

Temperature varying from 38.5° to 39.5°.

Urine, acid, albumen positive, slight sugar, some hyaline and abundant granular casts. Sugar probably due to hypodermoclysis with lactose.

Fæces, negative.

Blood culture on July 6, 1921, was negative.

Agglutination tests for *Bacillus typhosus* and for *B. paratyphosus* A and B were negative.

Blood counts: Leucocytes, 6,000; neutrophiles, 52 per cent; small lymphocytes, 36 per cent; large lymphocytes, 11.5 per cent; basophiles, 0.5 per cent.

Clinical diagnosis.—Fever, typhoid; severe toxæmia; pneumonia, hypostatic, bilateral; hæmorrhage, intestinal.

Morbid anatomy.—Autopsy 8470. The findings are those of typhoid with œdema and congestion of the lungs.

HISTOPATHOLOGY

Liver.—Hæmangioma; focal necrosis, typhoid; large *Schistosoma* nodules without eosinophilic infiltration and few giant cells; in the mesenteric lymph nodes, *Schistosoma* nodules and focal areas of necrosis. Some eggs with giant cells are also seen in the periphery of the areas of focal necrosis due to typhoid. Marked œdema and congestion are seen in the sections of the lungs, but no ova. Sections of the other organs are free from ova and eosinophilic infiltration.

ANATOMIC DIAGNOSIS

Intestinal hæmorrhage; acute ulcerative enteritis, acute lymphadenitis, acute splenitis, typhoid; schistosomiasis; hæmangioma, liver.

EIGHTH CASE

T. A., male, 65 years old (?), Filipino, laborer, was found unconscious in Plaza Goiti, Manila. Admitted to the Philippine General Hospital on November 25, 1921. He is well built, robust, and well nourished. Right pupil is smaller than the left which is distinctly dilated. Eyeballs are prominent and the intraocular pressure is increased. Patient is snoring. Area of dullness of the heart is slightly increased to the left. Heart beat is slow, with an extra systole every five or ten beats. Liver and spleen not palpable. Both extremities of the right side are paretic and placid; patient unable to extend or flex them as he can those of the left side. Radial artery is rigid and cannot be compressed. Blood pressure: Systolic, 230 millimeters; diastolic, 100 millimeters.

Blood examination: White count, 27,000, with 93 per cent neutrophiles, 4 per cent small lymphocytes, and 3 per cent large mononuclears.

Urine examination, albumen, very strongly positive; specific gravity, 1,006; casts, hyaline and granular; sugar, negative.

Clinical diagnosis.—Cerebral hæmorrhage, arteriosclerosis, and chronic interstitial nephritis.

Morbid anatomy.—Autopsy 8716. A well-developed and well-nourished, old Filipino man. The peritoneal cavity does not contain any fluid. The intestinal coils are pinkish and apparently normal. The urinary bladder is distended with urine, otherwise it is apparently normal. The spleen is very small and attached with fibrous adhesions to the surrounding tissue. The left pleural cavity is completely obliterated by fibrous adhesions. The heart is very large and slightly hypertrophied. Arteriosclerotic patches are found in the aorta and in the aortic valves. The left side is slightly atelectatic on account of the thick fibrous pleura. In the posterior surface of the inferior border of the superior lobe there is a piece of the lung and pleura which has changed into bone. The liver is soft and flabby and apparently normal in size. On section it shows congested surface. The liver weighs 1,468 grams. The alimentary tract is apparently normal.

The brain shows meningeal hæmorrhages in the left hemisphere and over the cerebellum. Section of the left side shows a large clot of blood in the internal capsule, and the left ventricle is completely filled with blood. The corpus collusum is intact. The right side shows a small amount of bloody fluid, but no destruction of brain tissue.

HISTOPATHOLOGY

Liver.—Few isolated ova in the portal areas with scanty cellular reaction.

ANATOMIC DIAGNOSIS

Cerebral and meningeal hæmorrhages, left; dilatation and hypertrophy of the heart; arteriosclerosis, senile; chronic interstitial nephritis; acute congestion of the lungs; obliterative pleurisy; ossification of lung, local; atrophy of the spleen; distension of the urinary bladder; schistosomiasis, liver.

NINTH CASE

Clinical data.—B. S., male, 25 years old, Filipino, foreman, residing in Manila, was admitted to the Philippine General Hospital on January 27, 1914, complaining of fever, chest pain, and cough.

Physical examination indicates lobar pneumonia, acute pericarditis, and dilatation of the heart.

Leucocytic count, 32,050 per cubic centimeter, and blood smear is negative for all the forms of malaria.

Stool examination is negative.

Urine contains a decided trace of albumen and few pale granular casts.

Morbid anatomy.—Autopsy 2990. Body of an emaciated adult, male Filipino, with about 100 cubic centimeters of clear yellowish fluid in the pericardial cavity, and fibrinous exudate over the surface of the right lung. The right ventricle of the heart is dilated. Right lung shows fibrinous pleurisy and lobar pneumonia. Liver weighs 1,607 grams. The lower edge is 8 centimeters below the costal ribs. There are areas of depression over its surface. It is brownish gray, hard, and firm; the surface is granular. On section numerous yellowish areas are present on the cut surface. In the sigmoid there is a hard nodule, which on section shows clear fluid surrounded by a thick capsule. Round worms and whipworms are present in the intestines.

HISTOPATHOLOGY

Liver.—Schistosoma nodules in the interlobular septa and fatty degeneration. Lung, red hepatization. The nodule in the sigmoid is composed of fibrous tissue with a cavity in the center containing a blue-staining material.

ANATOMIC DIAGNOSIS

Lobar pneumonia, right; fibrinous pleurisy; dilatation of the heart; cirrhosis of the liver; schistosomiasis, liver; cyst, colon.

TENTH CASE

Clinical history.—C. V., male, Filipino, 21 years old, born in Leyte and residing at present in Manila, was admitted to the Philippine General Hospital on May 27, 1922, pulseless and semiconscious due to profuse hæmatemesis. Companion states that patient has been in good health and that the day before admission he went to bed hungry, after heavy exercise. On the following morning and several times during the day he vomited blood. In the evening of the same day, he vomited so much blood that he collapsed.

On admission, he was very weak, collapsed, with profuse cold perspiration, pulseless, and semiconscious. The lungs and heart were apparently normal. No epigastric tenderness. In the ward his hæmatemesis was uncontrollable, and he died early on the following morning.

Clinical diagnosis.—Hæmorrhage, gastric.

The autopsy was performed four hours after death by Dr. E. W. Goodpasture.

Morbid anatomy.—Autopsy 9132. Body is that of a young Filipino male, well formed and well nourished. On removal of the sternum the lungs are found to be pale and expanded. There are firm fibrous adhesions posteriorly over the lower lobe and at the base on each side. Some congestion posteriorly. Near hilum posterior of left lung is a firm yellowish nodule (1 centimeter) lying on and attached to the pleura and embedded in a small indentation of the surface. On section through the lungs a few small scars are present in each posteriorly in lower lobes.

On opening the abdominal wall the peritoneal surfaces are found to be pale. There are numerous fibrous adhesions about the liver and colon.

The greater omentum is bound to the anterior surface of the liver above the gall bladder at one point. The cæcum is firmly attached to the retroperitoneal tissues, and the fatty tissue about it is firm from fibrosis. There is a similar fibrosis of pericolonic fat at many points, especially midway of the transverse and descending portions, where there are thickening, contraction, and scarring of the intestinal wall. Perirectal fibrosis firmly binds the rectum to the pelvis. In the omentum overlying the fundus of the stomach is an irregular, firm, light brown patch measuring 2 by 3 centimeters, involving fatty tissue, which was found later to be a mass of *Schistosoma* ova. The duodenum, jejunum, and colon are dark from bloody content, but the ileum is pale.

The œsophagus is very pale. No ulceration, inflammation, or dilated veins are noted. The stomach is of normal size. It contains a fresh blood clot forming a cast of the fundus about 10 centimeters in diameter. The entire mucosa is covered with blood. There is some post-mortem softening of the mucosa. No distinct ulceration is noted, but there are many minute erosions, in each of which is a thread of tarry blood. About 2 centimeters below the cardiac orifice are four slightly elevated areas of mucosa (0.5 centimeter) in the center of which appear to be small fresh ulcers. There is a coating of mucus over the mucosa. The duodenum and jejunum are filled with softened fresh blood clot. The blood adheres to the mucosa; when it is removed no gross ulceration is evident, but minute threads of bloody material are in the mucosa as if there had been bleeding from many small points. The remainder of the small intestine is bloodless, but the entire colon is filled with black sticky tarlike material, evidently from a previous hæmorrhage. The mucous membrane of the small intestine is otherwise normal in appearance. About 4 centimeters above the ileocæcal valve there is a patch (1 centimeter) in the serosa which is brown and dry like the area in the omentum. An *Ascaris* lies in the ileum.

Large intestine.—Two large *Trichuris* are attached to the mucosa. When the tarry content is washed away the mucosa is found to be irregularly thickened (1 or 2 millimeters) and slightly rough. The thickenings are in irregular patches and in them the mucosa is finely perforated in places, giving them a worm-eaten appearance. There are a few granular elevations of mucosa, and one or two small cystlike projections (3 to 4 millimeters) which appear to contain blood-stained material. Two of these elevations take a linear course, as if following a submucous blood vessel. The surface of these mucous thickenings has a faint brownish discoloration, and in some of them the induration involves the entire bowel wall. The appendix is normal in size, the mucosa pale and smooth except at the tip which contains a firm brown nodule.

There are a few isolated areas of thickening in the ascending colon; about midway of the transverse portion the bowel wall is indurated and constricted for a length of 3 centimeters. In this area there is an adhesion of mucous surface which divides the lumen by the formation of a small lateral channel. Here the mucosa is thickened, finely granular and delicately perforated, and the entire bowel wall is indurated. A firm nodule (2.5 by 1.5 centimeters) projects from the serous surface. A few scattered patches of thickening intervene between this portion and the mid-descending colon where there is another similar zone of induration and constriction. Below this are a few small areas of thickening until the rectum is reached, which appears normal.

Almost throughout the entire length of the colon the mesenteric fat is indurated and scarred, especially about the cæcum and the rectum.

Liver weighs 1,347 grams. It appears small and is grossly lobular from scarring. The lobules measure 4 or 5 centimeters. On opening the abdominal wall the liver was concealed by adhesion with the omentum above the gall bladder. The surface of the liver is rough and lobular, but there is no diffuse induration. Two nodules lie embedded in the capsule anteriorly over the right lobe. They measure 1 centimeter and are firm and brownish. The hepatic parenchyma is pale gray. On section there is irregular scarring which seems to be about the larger portal channels which are surrounded by a wide zone of tough silvery fibrous tissue. The spleen is greatly enlarged, weighing 565 grams. The capsule is slightly thickened. On section the cut surface is grayish purple. Trabeculæ and blood vessels are prominent. Malpighian bodies are diffuse, and on the pulp are numerous dots (1 to 2 millimeters) which are opaque, golden brown, and seem to follow the distribution of the blood vessels. About many of these is a dark red zone of hæmorrhage. There are a few small points of hæmorrhage elsewhere.

Ureters and urinary bladder appear normal.

Portal vein clot was removed from portal vein and placed in salt solution. Four specimens of *Schistosoma*, two males and two females, were found. Two others were obtained from branches of the splenic vein.

Typical ova of *Schistosoma japonicum* were found in scrapings from the cæcum and from the omentum.

ANATOMIC DIAGNOSIS

Mucous erosions of gastric mucosa; gastric and intestinal hæmorrhage; anæmia; chronic colitis (*Schistosoma japonicum*); schistosomiasis (colon, omentum; peritoneum, liver, spleen, and lungs).

The infection of schistosomiasis is of long duration. In fitting the cases reported in this paper under the classification of Houghton,(17) we can place the first and tenth cases as terminal. The history of the second case, relative to the infection, is unknown. The third had hyperpyrexia due to typhoid. The fourth case shows a past history of occasional fevers and malaria, and died on account of ruptured appendiceal abscess. The fifth case died of ulcerative pulmonary tuberculosis; the eighth, of cerebral hæmorrhage; the ninth, of lobar pneumonia; and the tenth, of hæmatemesis.

The theory that high fever can stimulate the dissemination of the eggs is supported by the sixth case who had influenza three months before death, and since then had very severe headaches, and died with cerebral symptoms. At the autopsy a large necrotic area was found in the right temporal lobe of the brain and another, triangular in shape, in the anterior surface of the upper lobe of the left lung. The third and the seventh cases also confirm Houghton's view, for these died of typhoid fever, and some of the eggs seem to have been freshly laid in the tissues.

PATHOLOGY AND MORBID ANATOMY

The morbid anatomy depends on the presence of both the adult parasite and the ovum, and on the extent of the changes in the fixed tissue in the organs where both parasite and ova have lodged as emboli.

The penetration of the skin by the cercaria causes an intense erythema which was regarded by the Japanese workers as a skin disease and is called "kabure," while the clinical symptoms were supposed to be a special disease known as "katamaya fever." The evanescent urticarias, œdema, fever, and the cough and hæmoptysis in the early morning with areas of pulmonary dullness in the first stage of the disease(18) point to the existence of toxin secreted by the parasite and inflammation in the lungs due to its passage through this organ on its way to the intestinal circulation.

The local necrosis of the cells in the bed of the ovum, and the cellular and fixed tissue reaction show not only that the ovum acts as a foreign body, but also that toxin is secreted by the contained miracidium. This necrosis may be circumscribed, when it can be recognized only with the help of the microscope, or it may be large enough to be detected by the naked eye. It seems that a period of time is needed for this necrosis to develop, for in cases of hyperpyrexia, which hastens the dissemination of the ova, no necrosis is recognized around the freshly laid ova. It may be that the hyperpyrexia induces in the female parasite an early discharge of the ova, which, being immature, do not contain enough toxin to produce necrosis.

The necrotic substance disappears later, either by absorption, by phagocytosis, or by breaking into a neighboring cavity or lumen with or without the help of pyogenic microörganisms, and in this way the ova are discharged.

It seems that the endothelial leucocytes are the first ones to respond; that they coalesce to form giant cells in case one or two of them cannot engulf or kill the miracidium inside the ovum; and that the fibroblasts and the eosinophilic and round-cell infiltrations come later. The histological picture is, therefore, that of chronic productive inflammation.

The adult parasite is supposed to live at least two years in the definitive host, and thus oviposition occurs not only once or twice, but many times. Each time the ova are disseminated, an inflammation takes place in the organs where they are de-

posited, and the repeated inflammation, which as we have already described is of the productive type, gives rise to fibrosis in the substance of the different organs and in their capsules, in the form of nodules, scars, and fibrous adhesions. The liver was the only internal organ that contained the ova in all of the cases and, with the exception of two cases of typhoid and peritonitis, all had eosinophilic infiltration. As an extension from the inflammation of the liver, pleural adhesions in the right cavity were present in all, except in the case of peritonitis and in the last case of typhoid. Fibrous adhesions around the appendix were present in five cases. Polypoid growths and thickening of the wall of the colon were present in the first three cases and in the last case, and in all of these ova were seen in the sections. The mesocolic and retroperitoneal lymph nodes were enlarged in the first three cases. Not only were the mesenteric lymph nodes enlarged, but they also contained ova in almost all of the cases.

Eosinophilic infiltration was found in every organ containing ova. Eosinophilic infiltration was seen without the ova, in the heart in one instance, and in the spleen in another.

In no instance did the urinary bladder, kidneys, pancreas, prostate, testes, adrenals, or stomach contain either ova or eosinophilic infiltration.

As we have seen, the later symptoms and morbid anatomy depend not only on the presence of the emboli of ova, but also on the extent of the fixed tissue reaction, which in some cases may become so uncontrollable as to give rise to tumor formations. Such a condition has been noted by Mouchet and Frouvicle(30) in a case of fibromata of the wall of the appendix, where lateral-spined ova of *Schistosoma mansoni* were found embedded in the wall. Similar ova were discovered in a case of alveolar carcinoma of the liver with metastases in the lungs. These authors believe that bilharziasis causes mechanical irritation and this, as is well known, can give rise to cancer.

Pirie(32) says that the common occurrence of carcinoma of the liver among South African natives can be traced to cirrhosis of the liver caused by schistosomiasis.

If the infection is not of long duration and the immediate cause of death is some intercurrent disease, whose lesions have been superimposed on the mild infection of schistosomiasis, the findings at the autopsy table are not characteristic and the presence of the ova is revealed only by the microscope.

Letulle and Nattan-Larrier,(22) in their discussion of the hepatic lesions in human schistosomiasis, say:

> *Schistosoma japonicum* provokes marked perihepatitis and cirrhosis of the liver which is filled with ova, and the disorders caused by it are confined to the mesenteric vessels, the peritoneum, and the liver, while Egyptian bilharziasis attacks with preference the urinary tract and colon, and the lesions in the liver are very few. [Translation.]

The distribution of the ova in the different organs of this series of cases and the lesions in these organs coincide with the findings of these authors for *Schistosoma japonicum*.

The repeated finding by previous workers of ova of *Schistosoma japonicum* in stools, the absence of reported cases of either *S. hæmatobium* or *S. mansoni* from these Islands, as well as the finding of the adult worms and ova and the size of the ova found in our histological sections indicate that we are dealing with *S. japonicum*.

DISCUSSION AND PREVENTION

The high incidence in Manila shown in Table 1, is probably due to the lack of history from four of the cases in this report and because Manila, being the capital, contains more transients. The large number coming from Samar, the reports of previous workers, the yearly incidence at autopsy tables and laboratories, as well as the histories presented in this paper showing that almost all of the cases have never been out of the Islands, seem to indicate that the infection with *Schistosoma japonicum* is a menace to this country and is probably endemic.

TABLE 1.—*Cases of schistosomiasis reported from the Philippine Islands.*

Author.	Manila.	Samar.	Leyte.	Mindanao.	La Union.	Year.
Woolley						1906
Garrison	1	6	5	4		1906
Phalen and Nichols		1				1907
Willets	1		1		1	1908
P. Guazon	1					1918
This report	7	2	1			1912–22
Totals	10	9	7	4	1	31

Dr. Albert W. C. T. Herre, of the Bureau of Science, tells me that *Blanfordia nosophora* Robson has not yet been recorded in the Philippine Islands, although this species or members of the same genus may be found here. So far, the only successful intermediary host for *Schistosoma japonicum* is this snail; yet, Cort(5) has demonstrated that other fork-tailed cercariæ from the United States have shown several examples of lack of

specificity in the choice of an intermediary host and adaptability to a new host. This fact is true of *S. hæmatobium,* for the development of cercariæ in both *Bullinus contortus* and *B. dybowski* has been reported by Leiper(19) in Egypt, and in *Physopsis africana* by Cawson(3) in South Africa.

If the intermediary host does exist here, it can find in this country all the conditions favorable for its endemicity and spread; namely, warm climate, continuous rain, evergreen vegetation (which supplies abundant food for the snails), unsanitary methods for the disposal of human waste, the habit of our laborers compelled by necessity to wade the rice fields of going barefooted and, above all, the habit of eating partially cooked snails, which in some places are used as food, especially in time of famine.

Even if the intermediary host is not found in these Islands, the immigration of people who eat this snail and the possible entrance of infected individuals are a possible source of infection. Cort(8) found that this snail can resist drying during the shipping time from Japan to California, due to its ability to close the opening of its shell with its operculum, and that this resistance is limited to three months. Although he found that the cercaria within the snail is affected by desiccation and that the infected snails die more quickly than the uninfected, the distance from Japan to the Philippine Islands is so short that desiccation cannot be relied on to kill the snails when imported into our country.

AGE, SEX, AND OCCUPATIONAL INCIDENCE

Table 2 shows clearly that the infection is acquired at ages when the male has to work outdoors for his living.

TABLE 2.—*Age, sex, and occupational incidence in schistosomiasis.*

Author.	Age in years.				Sex.	Occupation.
	15–20	20–30	30–40	40+		
Woolley					M	Prisoner.
Phalen and Nichols		1			M	Soldier.
P. Guazon		1			M	Laborer.
This report	3	5		2	M	Prisoner and laborers.

The number of cases reported, the lowered resistance of the infected individuals, and the danger to the community must

impel us to determine the degree of infection already existing in this Archipelago, especially in Samar, by finding the adult worms or ova in the vertebrate hosts (man, cat, dog, mice, and possibly the carabao), and then to search for the intermediary host or hosts.

Should the infection be found endemic in the Philippine Islands sanitary efforts will be directed, of course, toward the hosts, both vertebrate and invertebrate, native and imported.

Leiper,(20) in investigating the etiology of bilharziasis in Egypt, hired small boys to search the pools and canals for snails and shellfishes, which were carefully examined in the laboratory in order to find the miracidium. Once this was found, Leiper was able to trace its life history outside of the human body and also the mode of infection.

To kill all the infected snails Leiper advocates the draining of pools and canals. Elgood and Thomas(10) claim that flocks of ducks can free the canals from snails. Miyagawa(27) states that if lime containing fertilizer (Kalkstickstoff) is scattered systematically over a field and its watercourses, all the *Schistosoma* ova and intermediary hosts will be destroyed. He observed that all the ova in the stools mixed with urine and putrefying material die in two weeks in summer and in sixteen days at other seasons. On the other hand, Cort found that it is hard to kill snails by chemicals, for they escape from water in which there is no food or which has become unsuitable for them, and that draining the breeding places would be effective only if these places were kept dry at least three months.

Lutz's(23) observation in Brazil, although it refers to *Schistosoma mansoni*, is worth noting, for he says that the larvæ could be hatched from ova many days after they had been expelled in the fæces; that contact with water is required for the ova to hatch; and that these prefer to stay on the surface of water. He also found that *Planorbis divaceus* Spix can be infected, infection taking place by way of the antennæ, and that other flat and long snails attract larvæ through the antennæ, but that the evolution of the parasite is not complete in them. He further states that growth is checked by low temperature.

Manson(24) states that cercariæ live only forty-eight hours after being discharged from the snail, but a snail may remain infected over a long period and continue to give off cercariæ, and these can pass through the ordinary municipal filter bed

without difficulty. However, they are easily killed by most of the ordinary germicides used in water purification.

The proper disposal of waste, the prevention of ingress of cercariæ into the skin, and the appropriate treatment of the affected vertebrate host are the means of protecting the individual and of preventing him from being a source of danger to others.

The only known drug of importance in the treatment of disease caused by the other two allied members, *Schistosoma hæmatobium* and *S. mansoni,* is tartar emetic, which was first employed by McDonagh(25) and extensively used with success by Christopherson,(4) and their success has been corroborated by other workers. Analogy suggests that the same treatment be followed in infections of schistosomiasis.

CONCLUSIONS

1. The ten cases of infection with *Schistosoma japonicum* reported in this paper are not an index of the extent of the existing infection in the Philippine Islands, nor are they a complete index of its frequency in our autopsies. Probably many more cases would be recognized if more-thorough histological examination were made of every corpse that comes to the morgue, as the ova were revealed only by the microscope in many cases of this series.

2. None of these cases was diagnosed ante mortem, partly due to the general belief that schistosomiasis is absent from the Islands and partly because of the clinical symptoms, which in a subtropical country can be interpreted as those of malaria, typhoid, dysentery, portal cirrhosis, etc. Another cause is the difficulty of finding the ova in the stools and, when found, to recognize them.

3. A survey of the existing degree of infection in Manila and in Samar, as well as of the presence of its intermediary host, is advisable in order to facilitate the enforcement of preventive measures.

ACKNOWLEDGMENT

I am indebted to Dr. Ernest W. Goodpasture for his advice in the preparation of this paper.

BIBLIOGRAPHY

1. Bovaird, D., and Cecil, R. L. Journ. Am. Med. Sci. **148** (1914) 187.
2. Castellani, A., and Chalmers, A. J. Manual of Tropical Medicine. New York, William Wood & Co., ed. 3 (1920).
3. Cawson, F. G. Journ. Parasit. **3** (1917) 131.

4. CHRISTOPHERSON, J. B. Brit. Med. Journ. 2 (October 18, 1919) 484.
5. CORT, W. W. Journ. Parasit. 4 (1918) 171.
6. CORT, W. W. Univ. of Cal. Bull. Zoo. 18 (1919) Nos. 17 and 18.
7. CORT, W. W. Univ. of Cal. Pub. Zoo. 18 (1919) 509.
8. CORT, W. W. Journ. Parasit. 6 (1920) 84.
9. CROWELL, B. C., and HAMMACK, R. W. Philip. Journ. Sci. § B 8 (1913) 173.
10. ELGOOD and THOMAS. Lancet (October 11, 1919) 636.
11. FAIRLY, N. H. Proc. Roy. Soc. Med. 13 (1919) No. 1.
12. FAIRLY, N. H. Journ. Roy. Army Med. Corps 32 (1919) 243.
13. FANTHAM, H. B., STEPHENS, W. W., and THEOBALD, F. V. The Animal Parasites of Man. London, John Bale, Sons & Danielsson, Limited ed. 1 (1916).
14. FRIEDBERGER, cited by ZINSSER, H. Infection and Reinfection. New York, The Macmillan Co. ed. 2 (1918).
15. GARRISON, P. E. Philip. Journ. Sci. § B 3 (1908) 204.
16. HEISER, V. G. Philip. Journ. Sci. § B 3 (1908) 71.
17. HOUGHTON, H. S. Journ. Trop. Med. Hyg. 13 (1910) 185.
18. LANNING, R. H. U. S. Naval Med. Bull. 8 (1914) 16.
19. LEIPER, R. T. Brit. Med. Journ. 1 (1916) 411.
20. LEIPER, R. T. Ed. Journ. Am. Med. Assoc. 75 (1920) 761.
21. LETULLE, M. Arch. Parasit. 9 (1905) 329.
22. LETULLE, M., and NATTAN-LARRIER. Bull. Soc. Path. Exot. 2 (1909) 538.
23. LUTZ. Brazil Medico, Rio de Janeiro 30 (1916) 385.
24. MANSON, PATRICK. Tropical Diseases. New York, William Wood & Co. (1921).
25. MCDONAGH, J. E. Lancet (1916) 371.
26. MENDOZA-GUAZON, M. P. Revista Filipina de Med. y Farmacia 11 (1920) 14.
27. MIYAGAWA, I. Journ. Am. Med. Assoc. 68 (1917) 885.
28. MIYAGAWA, I., and TAKEMOTO. Journ. Path. & Bact. 24 (1921) 168.
29. MIYURA and SUDZUKI. Trop. Dis. Bull. 3 (1914) 289.
30. MOUCHET and FROUVICLE. Bull. Soc. Path. Exot. 2 (1908) 710.
31. PHALEN, J. M., and NICHOLS, H. J. Philip. Journ. Sci. § B 3 (1908) 223.
32. PIRIE, J. H. H. Abst. Journ. Am. Med. Assoc. 78 (1922) 546.
33. STRONG, R. P. Philip. Journ. Sci. § B 4 (1909) 291.
34. WILLETS, D. G. Philip. Journ. Sci. § B 9 (1914) 236.
35. WOOLLEY, P. G. Philip. Journ. Sci. 1 (1906) 83.

ILLUSTRATIONS

[Material for Plates 1 to 4 was taken from autopsy 2191; for Plate 5, from autopsy 9132. Plates 3 and 4 are from drawings by D. R. Matoto.]

Plate 1

Fig. 1. Colon, showing thickened appendices epiploicæ in schistosomiasis.
2. Surface of the liver in schistosomiasis.
3. Colon, showing polypoid growths in schistosomiasis.

Plate 2

Cross section of the liver in schistosomiasis.

Plate 3

Fig. 1. Lung, showing early nodule in schistosomiasis.
2. Lung in schistosomiasis.

Plate 4

Fig. 1. Cross section of an adult *Schistosoma*.
2. Portal area of the liver in schistosomiasis.

Plate 5. Schistosoma japonicum

Fig. 1. Adult female, with ova.
2. Adult male.
3. Ovum with miracidium.

1 2 3

PLATE 1.

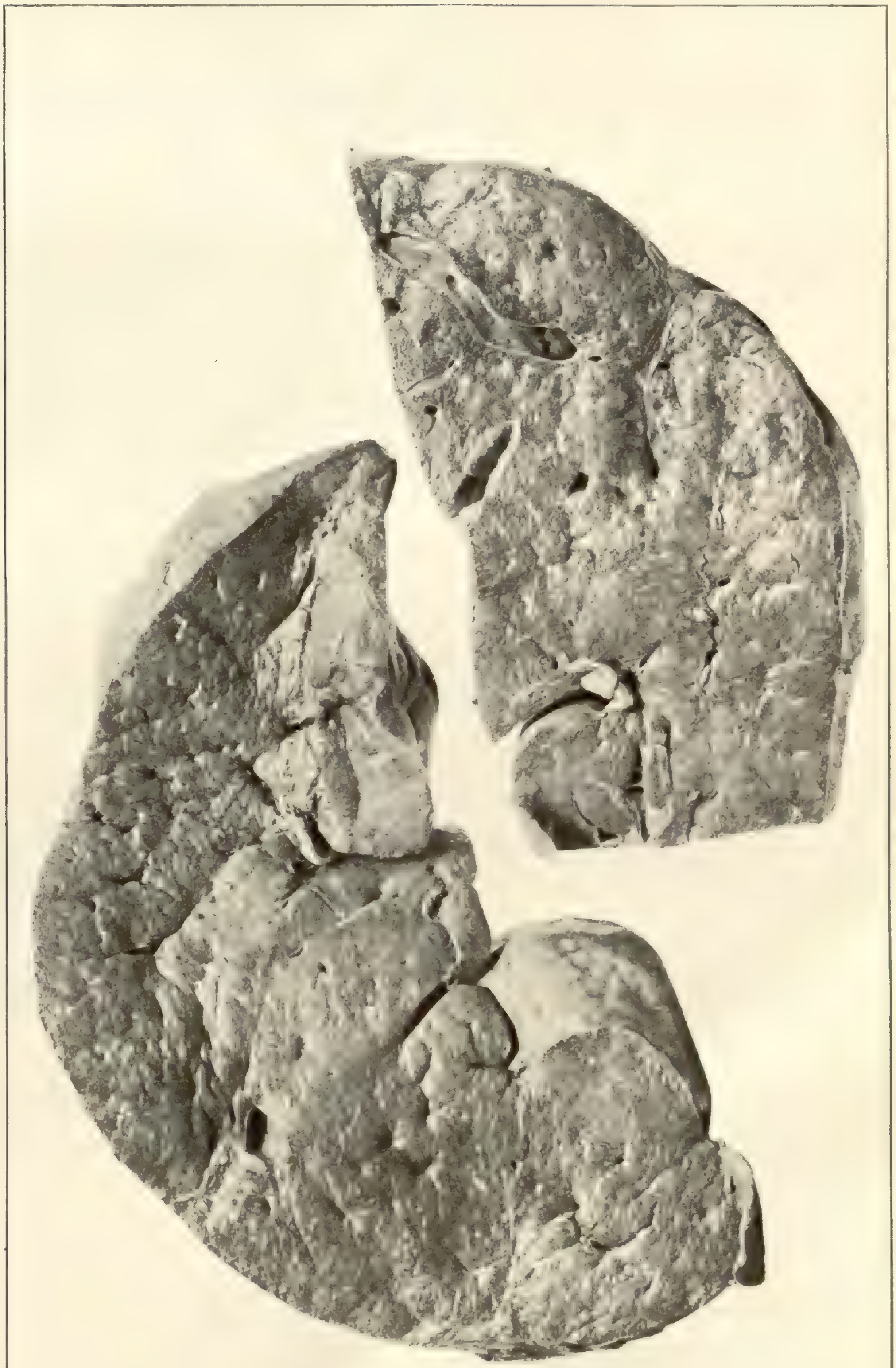


PLATE 2. THE LIVER IN SCHISTOSOMIASIS, CROSS SECTION. CASE 2191.

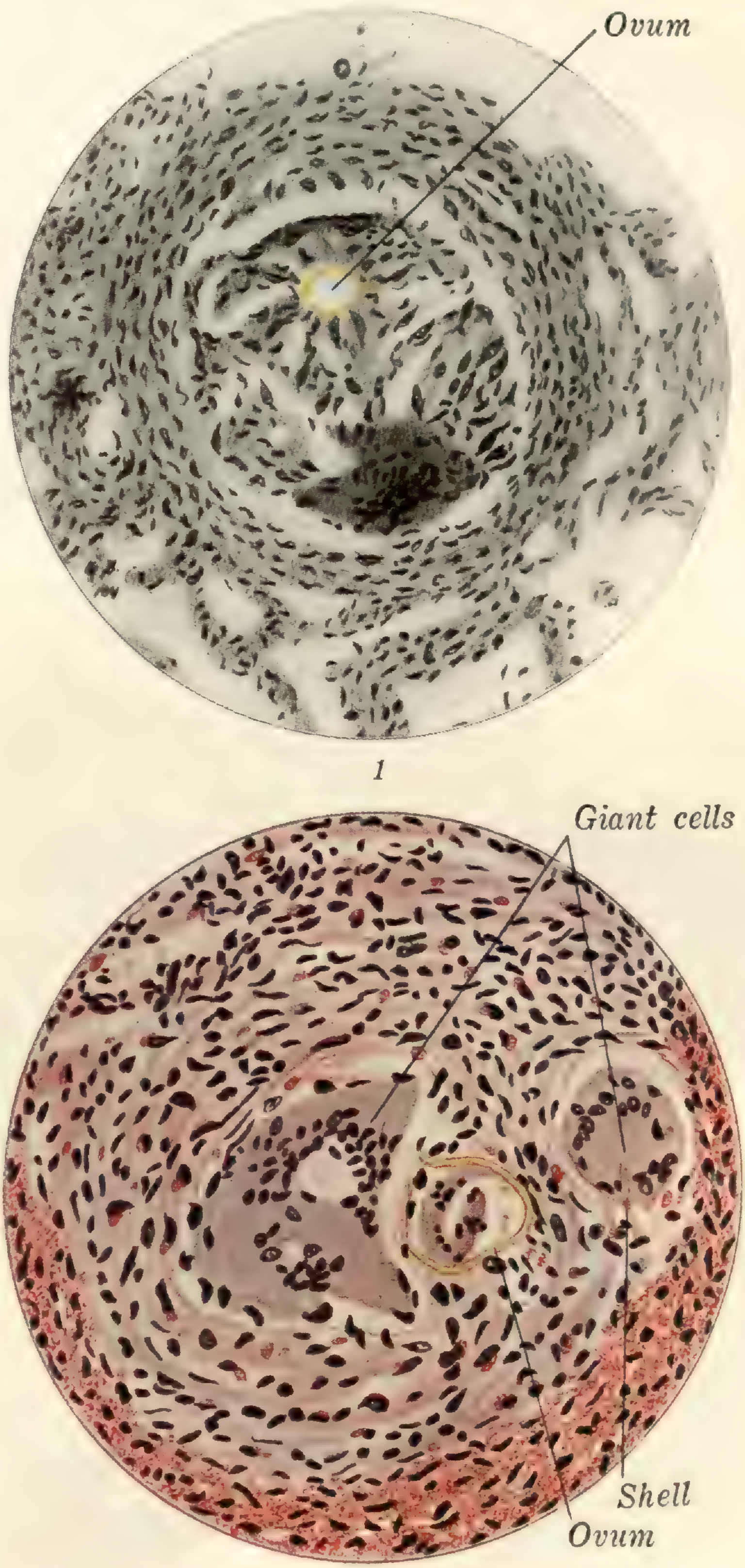
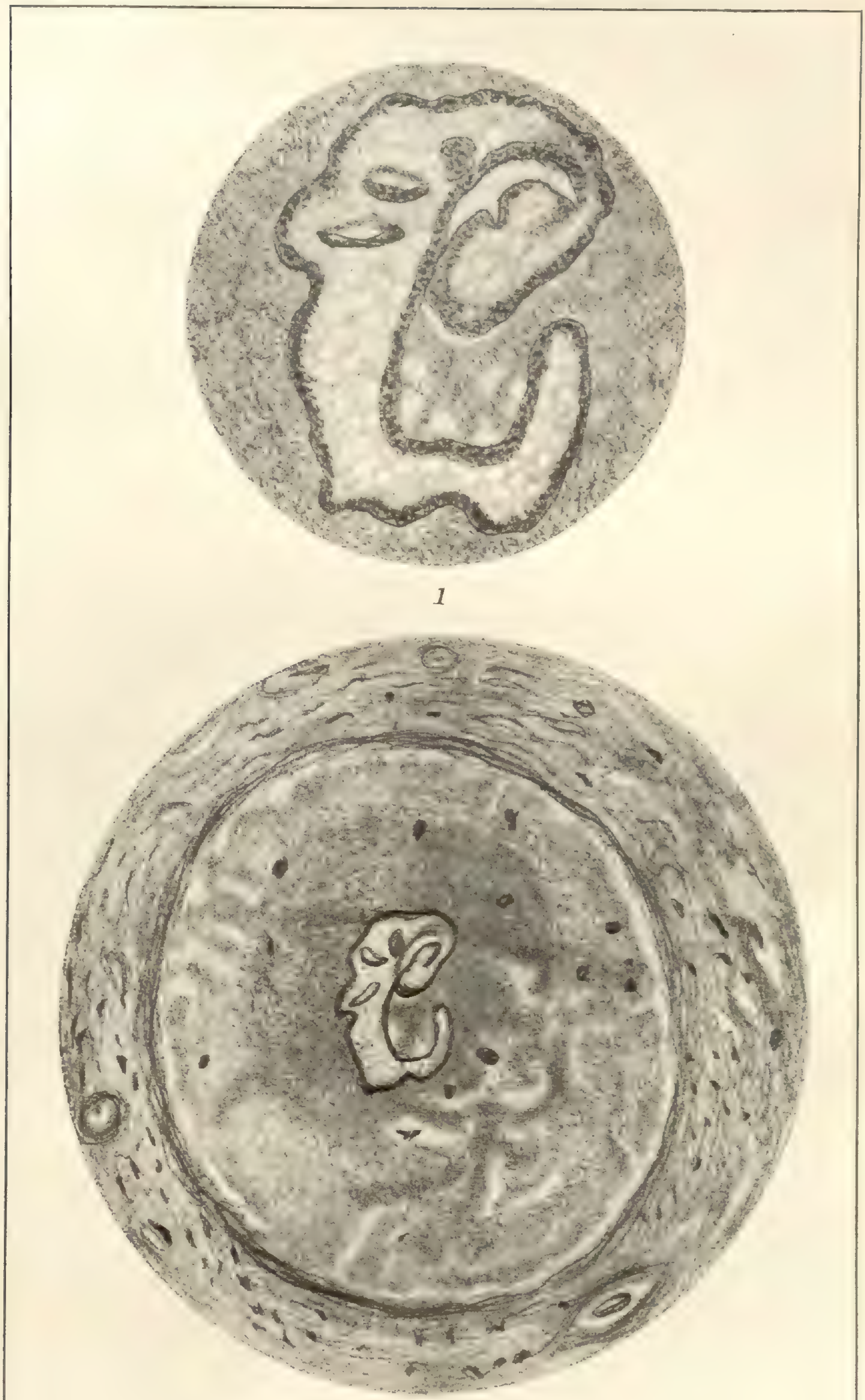


PLATE 3.



1

2

PLATE 4.

X. BEITRAG ZUR COLEOPTEREN FAUNA DER PHILIPPINEN [1]

Von W. SCHULTZE

Manila, Philippinen

VIER TAFELN

Durch meinen letzten Besuch in Europa, 1921, hatte ich Gelegenheit, an der Hand des Materials verschiedener Sammlungen, besonders des Zoologischen Museums, Dresden, eine weitere Anzahl philippinischer Arten zu bestimmen und Andere als neue Arten festzustellen, die ich in Folgendem bekannt mache.

CERAMBYCIDÆ

Aphrodisium palawanum sp. nov.
Euclea gloriosa sp. nov.
Doliops multifasciata sp. nov.
Acronia ? alboplagiata sp. nov.

CURCULIONIDÆ

Pachyrrhynchus consobrinus sp. nov.
Pachyrrhynchus dubiosus sp. nov.
Pachyrrhynchus apicatus sp. nov.
Pachyrrhynchus sulphureomaculatus sp. nov.
Pachyrrhynchus gloriosus var. *abbreviatus* var. nov.
Pachyrrhynchus pulchellus var. *modestioroides* var. nov.
Pachyrrhynchus orbifer subsp. *azureus* subsp. nov.
Pachyrrhynchus halconensis sp. nov.
Pachyrrhynchus postpubescens sp. nov.
Pachyrrhynchus regius sp. nov.
Pachyrrhynchus pseudoproteus sp. nov.
Pachyrrhynchus semiignitus sp. nov.
Pseudapocyrtus apicatus sp. nov.
Pseudapocyrtus catanduanensis sp. nov.
Metapocyrtus (*Artapocyrtus*) *octomaculatus* sp. nov.
Metapocyrtus (*Metapocyrtus*) *lindabonus* sp. nov.
Metapocyrtus (*Metapocyrtus*) *atocanus* sp. nov.
Metapocyrtus (*Metapocyrtus*) *sumptuosus* sp. nov.
Metapocyrtus sumptuosus var. *aureatus* var. nov.
Metapocyrtus (*Metapocyrtus*) *interruptostriatus* sp. nov.
Homalocyrtus maculatus sp. nov.
Neopyrgops panayensis sp. nov.
Alcides (*Metallalcides*) *butuanensis* sp. nov.
Alcides (*Metallalcides*) *gubatanus* sp. nov.
Alcides (*Metallalcides*) *mangyanicus* sp. nov.
Eugithopus uhlemanni sp. nov.

Die hier beschriebenen Curculioniden gehören zum grössten Teil wiederum den Pachyrrhynchinen an. Diese Gruppe findet

[1] Der "Neunte Beitrag z. Coleopteren Fauna der Philippinen" erschien in der Deutschen Entomol. Zeitschr. (1922) 36–45, Taf. 1; alle vorhergehenden Beiträge im Philippine Journal of Science.

in den Philippinen ihre grösste Entwickelung und Verbreitung und ist durch eine ganze Anzahl für die Philippinen endemische Gattungen vertreten, deren Arten meist sehr scharf specialisiert sind, bedingt durch den Inselkarakter der Philippinen. Wiederum sind fast alle Arten in ihrem Verbreitungsgebiet sehr eng beschränkt, teilweise auf einzelne kleine Inseln, oder auf grösseren Inseln wie Luzon, auf bestimmte hohe Gebirgszüge oder selbst einzelne Berge; so dass es in den meisten Fällen leicht ist, eine Art wieder zu erkennen und zu bestimmen, wenn der genaue Fundort bekannt ist. Auch eignet sich diese Gruppe besonders von allen Coleopteren, überhaupt Insekten, durch die grosse endemische Artenzahl (ebenfalls und in gleicher Weise auch die Landmollusken) zu Rückschlüssen auf die Beziehungen der Philippinen zu anderen Inseln, wie Celebes, oder Borneo, oder noch anderen Gebieten, als einstmalige, problematische Uebergangs- oder Verbindungsbrücken, für die in Frage kommenden Urderivationsformen. Besonders erwähnen möchte ich, dass bis jetzt kein Vertreter der Pachyrrhynchinen auf der Insel Palawan oder der dieser nahe liegenden Calamianes oder Busuanga Inselgruppe gefunden wurde, trotzdem auf Palawan genügend gesammelt wurde um sich in dieser Beziehung ein Urteil zu bilden. Ich selbst sammelte auf dieser Insel verschiedene Male an vielen Plätzen, teilweise für Monate (Bacuit, Taytay, Puerto Princesa und Iwahig, Ulugan Bay, etc.). Auch Prof. Baker's Sammler sowie G. Boettcher waren auf dieser Insel tätig. Die Fauna von Palawan, in Bezug auf Expansion von Arten schliest sich in ihren Hauptelementen an Borneo an, was auch schon Semper [2] und andere feststellen konnten, und in viel geringerem Maase an die Philippinen, aus welchem Grunde man die Abwesenheit von Pachyrrhynchinen auf dieser Insel erklären könnte, da ja obige Gruppe auf Borneo sehr spärlich vertreten ist durch die Gattung *Apocyrtidius* Heller. Die Elemente der Philippinen, mit Ausnahme der Insel Palawan, besonders aber obige Gruppe, zeigen die grösste Affinität zu denen von Celebes. Um das verwandtschaftliche Verhältniss der grossen Anzahl von Arten der Gattung *Pachyrrhynchus* unter sich näher kennen zu lernen sowie das Verhältniss dieser zu anderen Pachyrrhynchinen Gattungen, habe ich Untersuchungen über die männlichen Geschlechtsorgane vorgenommen. Leider konnte ich vorläufig, mangels Materials, nur eine ausserphilippinische Art zur Untersuchung heranziehen, *Pantorhytes plutus* Oberthür. Die Resultate dieser Untersuchungen sind durch Figuren, die alle im

[2] Reisen im Archipel der Philippinen, II 1 Tagfalter (1886–1892) 365.

relativ gleichen Grössenverhältniss, mittelst Abbé' schen Zeichenapparats und Zeiss Binocular Mikroskop gezeichnet sind, veranschaulicht. Die Abbildungen zeigen deutlich die grossen Formenunterschiede dieser Organe bei den Gattungen *Pachyrrhynchus, Pantorhytes, Metapocyrtus* Untergattung *Artapocyrtus, Metapocyrtus* Untergattung *Orthocyrtus*, und *Metapocyrtus* Untergattung *Homalocyrtus*, sowie der Gattungen *Pseudapocyrtus* und *Macrocyrtus*. Die grossen Unterschiede der Untergattung *Homalocyrtus* von der Gattung *Metapocyrtus* bedingt die Absonderung der Ersteren und Aufstellung als selbstständige Gattung.

Aphrodisium palawanum sp. nov. Tafel 1, Fig. 8, ♀.

Weibchen.—Kopf hell rötlich ockerfarbig, Flügeldecken hell rotbraun. Kopf, die Stirn durch eine gebogene Querfurche abgesetzt und konkav ausgehöhlt, kräftig verworren punktiert, mit einer Mittellängsfurche welche zwischen den Fühleransätzen endet. Fühler hell rötlich ockerfarbig, die letzten drei Glieder schwarzbraun. Scheitel des Kopfes sehr kräftig punktiert. Halsschild dicht und fein punktiert, nächst dem Vorder- und Hinterrande quer abgeschnürt, der mittlere Teil geschwollen, in der Mitte eine feine glatte Längslinie, die Seiten mit einem kräftigen stumpfen Dorn. Die Färbung des Halsschildes ist schwarzbraun, nur die Dornen und eine kleine Fläche je seitlich der Mitte ist rötlich ockerfarbig, die Oberseite ist äusserst fein bräunlich pubesziert. Schildchen schwarz, die Flügeldecken hell rot sehr schwach pubesziert. Unterseite schwarzblau, Mittel- und Hinterbrust fein silberglänzend pubesziert. Abdominalsegmente zerstreut punktiert, erstes und zweites Segment je seitlich am Hinterrande ebenfalls silberglänzend pubesziert. Beine rötlich ockerfarbig, mit Ausnahme der Schenkel, welche im mittleren, verdickten Teil schwarzbraun sind.

Weibchen: Länge, 36 Millimeter; Schulterbreite, 10. 6.

PALAWAN, Silanga (*M. Ramos*). Typus No. 17061, in der Sammlung des Bureau of Science, Manila.

Euclea gloriosa sp. nov. Tafel 1, Fig. 5, ♀.

Kopf und Halsschild metallisch glutrot, Flügeldecken grün und kupferig metallisch glänzend mit kremweissen Zeichnungen. Verwandt mit *E. pulchella* Schultze. Kopf, zerstreut punktiert, nach der Stirn zu feiner werdend, mit zwei divergierenden Tomentlängsstreifen, und einer schwach angedeuteten Mittelfurche. Seiten des Kopfes mit einem grossen kremweissen Tomentfleck. Fühler metallisch rot glänzend, viertes Glied, die

vordere Hälfte weiss, die hintere Hälfte sowie die folgenden Glieder schwarz tomentiert. Halsschild weitläufig zerstreut punktiert, die Punktierung nach den Seiten zu kräftiger und gröber sowie querrunzelartig zusammenlaufend. Seiten mit einer Tomentmakel am Vorder- und am Hinterrand, eine weitere Makel etwas vor den Vorderhüften. Flügeldecken im basalen Teil sehr kräftig, grob, zerstreut punktiert, nach der Mitte zu und nächst der Naht fein, nach den Seiten zu und im apikalen Drittel wieder stärker punktiert. An der Basis vor der Schulterbeule ein länglicher Tomentfleck und ein anderer nächst dem Seitenrand. Hinter dem Schildchen, von der Naht schräg nach hinten gerichtet, ein kurzer Tomentstreifen. In der Mitte der Decken zwei breitere parallele Querbänder und am Beginn des letzten Drittels ein zu den Letzteren ebenfalls paralleles aber sehr schmales Querband. Im Spitzendreieck ein Längsstreifen parallel zur Naht, ein anderer Tomentstreifen nächst dem Aussenrand und ein anderer kurzer makelartiger Streifen in der Mitte jeder Decke. Die Flügeldecken im basalen Teil und hinter der Mitte fein schwärzlich pubesziert. Unterseite, Mittelbrust je seitlich mit drei Tomentflecken, erstes Abdominalsegment am Hinterrand mit einem breiten Tomentband, welches in der Mitte unterbrochen ist. Die folgenden Segmente je seitlich kremweiss, und an den Hinterrändern unterbrochen tomentiert. Beine, die Schienen schwarz pubesziert.

Männchen: Länge, 15.5 Millimeter; Schulterbreite, 5.8. Weibchen: Länge, 18 Millimeter; Schulterbreite, 7.

MINDANAO, Surigao, Surigao (*C. F. Baker 16118*). Typus des Weibchen in meiner Sammlung; des Männchen in der Sammlung von Prof. C. F. Baker.

Doliops multifasciata sp. nov. Tafel 1, Fig. 6.

Schwarz, dunkel grünlich glänzend, Halsschild mit weissen seidenartig glänzenden Längstomentstreifen, Flügeldecken mit Tomentquerbinden. Am nächsten verwandt mit *D. geometrica* Waterhouse. Kopf mit einer feinen Dorsalmittelfurche und einem Mittellängsstreifen welcher bis zum Scheitel reicht. Seiten des Kopfes unterhalb des Auges mit einem Tomentfleck. Halsschild länger wie breit, mit einem schmalen Tomentlängsstreifen in der Mitte, einem anderen, etwas breiteren, je seitlich und einem breiten Tomentstreifen auf den Seiten vom Vorder- bis zum Hinterrand reichend. Flügeldecken im basalen Teil grob zerstreut raspelkörnig punktiert, die Punktierung wird nach der Mitte zu feiner und weitläufiger und verschwindet im apikalen Drittel. Jede Decke im basalen Drittel mit zwei

ziemlich breiten Tomentquerbinden, welche nächst der Naht und dem Seitenrande gekrümmt sind und daselbst zusammenlaufen. Zwei weitere Tomentquerbinden hinter der Mitte, die ebenfalls an der Naht und am Seitenrand zusammenlaufen. Im apikalen Drittel ein Tomentlängsstreifen welcher von der vierten Querbinde bis zum Hinterrand reicht, dann am Seitenrand kurz fortgesetzt ist, um dann in schräger Richtung mit dem Längsstreifen zusammen zu laufen und auf diese Weise eine dreieckige Figur bildet. Die Apikalenden der Flügeldecken verrundet. Unterseite, Mittel- und Hinterbrust seitlich weiss tomentiert, erstes Abdominalsegment mit breitem Tomentstreifen am Hinterrand, in der Mitte unterbrochen, die folgenden Segmente, mit Ausnahme des letzten, mit einer Tomentmakel je seitlich. Schenkel mit je zwei kleinen weisslichen Tomentflecken, an der Innen- und Aussenseite, im apikalen Teil der Verdickung. Schienen schwarz, erstes und zweites Tarsenglied hellgrau pubesziert.

Länge, 12.5 Millimeter; Schulterbreite, 4.8.

MINDANAO, Provinz Bukidnon, Lindabon (*W. Schultze*). Typus in meiner Sammlung.

Acronia ? alboplagiata sp. nov. Tafel 1, Fig. 3.

Kopf und Halsschild glänzend schwarz, Flügeldecken blauschwarz mit grünen Reflexen und hell blassgrünen Tomentmakeln. Kopf zerstreut punktiert, mit einer grossen Tomentmakel auf der Stirn, welche durch einen stark ausgeprägten Mittellängskiel geteilt wird, der Letztere als feine Furche bis zum Scheitel fortgesetzt. Ein kleiner dreieckiger Tomentfleck auf den Seiten des Kopfes unterhalb des Auges. Halsschild breiter wie lang, sehr weitläufig zerstreut punktiert, Seiten je mit zwei grossen Tomentmakeln die in der Mitte zusammenlaufen. Flügeldecken weitläufig zerstreut punktiert mit drei Tomentmakeln an der Naht; eine grosse nächst der Basis, eine längliche in der Mitte, und eine andere nächst der Apex. Jede Decke mit weiteren fünf Makeln, eine sehr grosse auf der Scheibe etwas vor der Mitte, zwei andere seitlich von dieser und am Seitenrand gelegen, sowie zwei weitere hinter der Mitte, wovon eine grosse ebenfalls am Seitenrand gelegen ist. Unterseite; Prothorax hell blassgrün tomentiert, Meso- und Metathorax mit einer grossen Tomentmakel je seitlich. Erstes Abdominalsegment mit einer dreieckigen Makel in der Mitte und einer länglichen an den Seiten, drittes Segment mit einer kleinen Makel an den Seiten, die folgenden mit grossen Makeln, das Analsegment fein pubesziert und mit einer feinen Mittellängsfurche. Mittel- und Hinterschienen schwarz pubesziert.

Länge, 22 Millimeter; Schulterbreite, 8.

MINDANAO, Provinz Bukidnon, Lindabon (*W. Schultze*). Typus in meiner Sammlung.

Diese Art ist nahe verwandt mit *A. decimaculata* Schultze.[3]

Pachyrrhynchus consobrinus sp. nov. Tafel 2, Fig. 5, ♂.

Glänzend schwarz, Flügeldecken mit matten, farblosen Schuppenmakeln. Rüssel, in der Apikalhälfte fein zerstreut punktiert, Basalhälfte mit einem kräftig ausgeprägten dreieckigen Dorsaleindruck. Halsschield länger wie breit, glänzend schwarz, sehr fein zerstreut punktiert, eine kleine rundliche Schuppenmakel je seitlich der Mitte am Vorderrand, sowie eine andere, etwas hinter der Längsmitte und eine grosse Makel auf den Seiten über den Vorderhüften. Flügeldecken beim Männchen sehr länglich oval; beim Weibchen gedrungen oval, grösste Breite vor der Mitte, glänzend schwarz, mit einer scharf ausgeprägten abgekürzten Punktreihe in der hinteren Hälfte jeder Decke nächst dem Aussenrande, welche furchenartig nächst der Apex endet. Jede Decke mit zwei grossen rundlichen Schuppenmakeln an der Basis, drei weiteren eine Querreihe bildenden Makeln vor der Mitte, vier Makeln ebenfalls eine Querreihe bildend im apikalen Drittel, eine Makel im apikalen Dreieck, sowie eine kleine beiden Decken gemeinsame Nahtmakel hinter der Mitte und eine grosse Nahtmakel an der Apex. Die Beschuppung der Makeln ist graulich oder nahezu farblos, ähnlich wie bei *P. tristis* Heller.

Männchen: Länge, 17.6 Millimeter (ohne Rüssel); Breite, 6.3. Weibchen: Länge, 19 Millimeter (ohne Rüssel); Breite, 7.6.

LUZON, Bontoc (*W. Schultze*). Typus Männchen und Weibchen in meiner Sammlung.

Diese Art gehört in die Verwandtschaft von *P. pinorum* Pascoe und steht der *P. tristis* Heller am nächsten, von der mir Exemplare aus Luzon, Provinz Benguet, vorliegen und von welcher ich die Typen untersuchte. *Pachyrrynchus consobrinus* unterscheidet sich von *P. tristis* Heller besonders durch die äusserst glatten, polierten Flügeldecken die keinerlei Runzelung oder Andeutung von Längsfurchen, wie bei letzterer Art, zeigen. Auch sind die Schuppenmakeln viel grösser als bei obiger Art.

Pachyrrhynchus dubiosus sp. nov. Tafel 3, Fig. 4.

Schwarz, Flügeldecken mit breiten unregelmässigen Längsfurchen die sehr spärlich mit kleinen nahezu farblosen Schüpp-

[3] Philip. Journ. Sci. 15 (1919) 548, Taf. 1, Fig. 17.

chen besetzt sind. In die nähere Verwandtschaft von *P. pinorum* Pascoe und *P. lacunosus* Heller gehörig. Rüssel in der Apikalhälfte zerstreut punktiert, Basalhälfte mit kräftig ausgeprägtem Dorsaleindruck und Mittellängsfurche. Halsschild länger wie breit, fein zerstreut punktiert. Flügeldecken lederartig gerunzelt. Die längsfurchenartigen Eindrücke auf dem Grunde schwach gekielt. Die Zwischenräume zwischen den Eindrücken wulstig erhaben. Unterseite und Schenkel unbeschuppt.

Männchen: Länge, 18 Millimeter (ohne Rüssel); Breite, 7. Weibchen: Länge, 21 Millimeter (ohne Rüssel); Breite, 8.5.

LUZON, Provinz Benguet, Berg Santo Tomás und Haight's Place (*W. Schultze*). Typen in meiner Sammlung.

Diese Art steht in systematischer Beziehung in der Mitte zwischen *P. pinorum* Pascoe und *P. lacunosus* Heller.

Pachyrrhynchus apicatus sp. nov. Tafel 3, Fig. 1.

Schwarz glänzend, Kopf, Halsschild und Flügeldecken mit grossen grünlichgelben Schuppenmakeln. Verwandt mit *P. venustus* Waterhouse. Rüssel in der Apikalhälfte fein zerstreut punktiert, Basalhälfte mit einem etwas flachen dreieckigen Eindruck mit einer Mittellängsfurche. Ein weiterer schwacher Eindruck auf der Stirn, mit einer grossen Schuppenmakel, Seiten des Kopfes unter dem Auge ebenfalls. Halsschild länger wie breit, fein und gleichmässig zerstreut punktiert, je seitlich der Mitte mit einer grossen länglichen Schuppenmakel und einer Makel an den Seiten über den Vorderhüften. Flügeldecken länglich eiförmig, fein lederartig gerunzelt. Die Decken an der Apex in eine kurze schnabelartige Spitze auslaufend, ausgeprägt beim Weibchen, beim Männchen verrundet. Jede Decke mit zehn Schuppenmakeln; zwei grössere an der Basis; drei bilden eine Querreihe vor der Mitte, von welchen die am Seitenrand gelegene am grössten und nach hinten gerichtet ist; zwei im apikalen Drittel; eine dreieckige Makel nächst der Apex; sowie zwei Suturalmakeln, eine in der Mitte und die andere im apikalen Viertel. Unterseite der Vorder-, Mittel-, und Hinterbrust ebenfalls grünlichgelb beschuppt. Erstes und zweites Abdominal-sternit je seitlich mit einer grossen Schuppenmakel. Schenkel mit einer Schuppenmakel unterseits nächst den Kniegelenken und einem kleinen Schüppchenschwarm oberseits.

Männchen: Länge, 17.6 Millimeter (ohne Rüssel); Breite, 7. Weibchen: Länge, 19 Millimeter (ohne Rüssel); Breite, 8.

POLILLO (*W. Schultze*). Typen in meiner Sammlung.

Pachyrrhynchus sulphureomaculatus sp. nov. Tafel 2, Fig. 1, ♀.

Glänzend schwarz, mit schwefelgelben Schuppenmakeln. Rüssel in der Apikalhälfte schwach zerstreut punktiert, in der Mitte querstufig verrundet abgesetzt, die Basalhälfte mit Mittellängsfurche und nach den Seiten zu abgeschrägtem Dorsaleindruck, welcher auf der Stirn verläuft. Stirn mit einem runden Schuppenfleck. Halsschild so breit wie lang, je seitlich in der Mitte mit einer ovalen Schuppenmakel, sowie auf den Seiten eine grosse Längsschuppenmakel über den Vorderhüften. Flügeldecken kurz gedrungen oval, ganz glatt; ohne Spuren von Punktreihen. Jede Decke mit dreizehn rundlichen und ovalen Schuppenmakeln; drei Makeln nächst der Basis, drei weitere ebenfalls eine Querreihe bildend etwas vor der Mitte von welchen die nächst dem Seitenrand gelegene sehr gross und lang gestreckt ist; eine weitere grosse längliche Seitenrandmakel etwas hinter der Mitte, vier Makeln im apikalen Drittel und eine kleine Nahtmakel etwas hinter der Deckenmitte sowie eine andere Nahtmakel im apikalen Viertel. Beine ebenfalls schwarz, Schenkel mit einer länglichen scharf ausgeprägten Schuppenmakel auf der Unterseite, nächst den Kniegelenken.

Weibchen: Länge, 15.5 Millimeter (ohne Rüssel); Breite, 7.

MINDANAO, Provinz Cotabato, Cotabato (*C. M. Weber*). Typus in meiner Sammlung.

Diese Art hat die Flügeldecken sehr gedrungen, kurz oval, in Form ähnlich wie *P. ardentius* Schultze.

Pachyrrhynchus gloriosus Faust **var. abbreviatus** var. nov.

Die Längsstreifen des Halsschildes, je seitlich der Mitte am Hinterrand, sind breit makelartig reduziert, der Schuppenstreifen über den Vorderhüften breiter als bei der Stammform. Flügeldecken; die Längs- und Querstreifen sind fragmentär als relativ breite Längs- oder Querschuppenmakeln vorhanden, nur der breitere Seitenrandstreifen ist vollständig, der erste Schuppenlängsstreifen im apikalen Drittel erhalten.

Männchen: Länge, 14 Millimeter (ohne Rüssel); Breite, 6.

LUZON, Provinz Bontoc.

Pachyrrhynchus pulchellus Behr. **var modestioroides** var. nov.

Dunkel kupferrot glänzend. Halsschild wie bei der Stammform gezeichnet. Flügeldecken mit je nur drei breiten, blassgrünen Längsschuppenstreifen, dem *P. inclytus* Pascoe dadurch sehr ähnlich.

Männchen: Länge, 13 Millimeter (ohne Rüssel); Breite, 5.

LUZON, Provinz Benguet, Berg Polis (*W. Schultze*).

Da ich Gelegenheit hatte die von Heller beschriebene *P. bakeri* [4] zu untersuchen, konnte ich feststellen dass dieses Stück nur als eine der vielen Formen von *P. pulchellus* Behrens, und als var. *bakeri* dieser Art, anzusehen ist.

Pachyrrhynchus inclytus Pascoe.

Pachyrrhynchus inclytus PASCOE, Journ. Linn. Soc. London 11 (1873) 155.

Bei der genauen Durcharbeitung meines grossen Materials von *P. modestior* Behrens kam ich zur Ueberzeugung dass letztere Art identisch mit *P. inclytus* Pascoe ist. Auch diese Art tritt in verschiedenen Lokalformen auf und ist *P. modestior* Behrens als *P. inclytus* var. *modestior* zu stellen, ebenfalls var. *transversatus* Heller welche wiederum als eine Combination der von Behrens [5] erwähnten var. β Behr. und var. γ Behr. anzusehen ist.

Pachyrrhynchus orbifer subsp. azureus subsp. nov. Tafel 2, Fig. 8, ♂.

Schwarz, Halsschild und Flügeldecken mit lapizlazuli blauen Schuppenbändern. Kopf, Stirn mit länglichem Schuppenstreifen und Seiten des Kopfes mit einer Schuppenmakel. Halsschild mit einem Querband etwas vor der Mitte, welches sich auf den Seiten makelartig erweitert und einem keilförmigen Mittellängsstreifen welcher von dem Querstreifen bis zum Hinterrand reicht. Flügeldecken undeutlich gereiht-punktiert, mit einer grossen querbandartigen Makel an der Basis, einem Querband in der Mitte und einer grossen Makel im apikalen Drittel welche sich längs des Seitenrandes mit dem mittleren Querband verbindet. Schenkel mit einer Ringmakel nächst den Kniegelenken und einer kleinen länglichen Makel vor der Mitte.

Männchen: Länge, 12 Millimeter (ohne Rüssel); Breite, 5.6.

LUZON, Provinz Benguet, Kabayan (*W. Schultze*).

Pachyrrhynchus halconensis sp. nov. Tafel 2, Fig. 3, ♀.

Glänzend schwarz mit metallisch blassgrünlichen (Männchen) oder kupferig schimmernden (Weibchen) Schuppenzeichnungen; in die Verwandtschaft von *P. phaleratus* Waterhouse gehörig. Rüssel nach der Apex zu stark divergierend, in der Apikalhälfte zerstreut punktiert, die Basalhälfte mit einem kräftig ausgeprägten dreieckigen Eindruck mit Schuppenmakel, die Seitenränder schwielig hervortretend. Der Eindruck verläuft auf der Stirn.

[4] Philip. Journ. Sci. 19 (1921) 542.
[5] Stett. Ent. Zeitg. 48 (1887) 241.

Die Letztere ebenfalls mit einer dreieckigen Schuppenmakel. Halsschild etwas breiter wie lang, sehr fein zerstreut punktiert, mit einem Schuppenquerstreifen vor der Mitte, welcher je seitlich nach dem Vorder- und Hinterrande abzweigt und eine grosse Kahlmakel auf den Seiten umschreibt. In der Mitte am Hinterrande eine längliche keilförmige Makel welche vor dem Querstreifen endet. Flügeldecken beim Männchen länglich oval, beim Weibchen gedrungen oval, sehr schwach angedeutet, weitläufig gereiht-punktiert. Die Decken mit einer unregelmässigen Querbinde in der Mitte, in der Basalhälfte im dorsalen Teil ein Schuppenlängsstreifen welcher sich nach der Basis zu erweitert und als breiter Seitenrandstreifen bis zur Apex fortsetzt um an dieser Stelle sich makelartig zu erweitern, besonders beim Weibchen und sich mit einem makelartigen Längsstreifen, welcher bis zur Querbinde reicht, zu verbinden. Beim Weibchen findet sich noch ein Nahtstreifen in der hinteren Deckenhälfte welcher in seinem Verlauf unterbrochen ist und nächst der Apex eine Nahtmakel bildet. Unterseite, Mittel- und Hinterbrust sowie erstes Abdominalsegment mit einer Schuppenmakel je seitlich. Schenkel mit einer oberseits unterbrochenen breiten Schuppenringmakel nächst den Kniegelenken.

Männchen: Länge 13.6 Millimeter (ohne Rüssel); Breite, 6. Weibchen: Länge, 17 millimeter (ohne Rüssel); Breite, 7.8.

MINDORO, Vorberge des Berges Halcon (*M. Ramos*). Typen in meiner Sammlung.

Diese Art scheint in Bezug auf Zeichnung ziemlich zu variieren. Die Längsschuppenstreifen im dorsalen Teil der Decken erreichen beim Männchen die Querbinde nicht, auch ist bei diesem der Nahtstreifen in der hinteren Deckenhälfte nicht vorhanden. Von *P. phaleratus* Waterhouse welche auf die Catanduanes Insel beschränkt ist unterscheidet sich diese Art leicht durch die anders geformten Flügeldecken.

Pachyrrhynchus postpubescens sp. nov.

Dunkel kupferig rot glänzend, Halsschild mit blassgrünen Längsschuppenstreifen, Flügeldecken mit Schuppenbändern die in ihrer Anlage und Form mit denen von *P. speciosus* Waterhouse nahezu übereinstimmen. Rüssel in der Basalhälfte mit kräftig ausgeprägtem Dorsaleindruck, dessen Seiten wulstig hervortreten. Stirn mit einer ovalen Längsschuppenmakel mit einem Kahlstrich in der Mitte, Seiten des Kopfes mit einer Schuppenmakel unter dem Auge. Halsschild kaum so breit wie lang, die grösste Breite hinter der Mitte, mit zwei Dorsallängs-

streifen die nach dem Vorderrande zu schwach divergieren. Jede Seite mit zwei weiteren Längsstreifen die am Vorder- und Hinterrand verbunden sind. Flügeldecken kräftig gereiht-punktiert. Jede Decke im basalen Drittel mit einem Schuppenband welches in Form eines quergestellten länglichen Ovals von der ersten Punktreihe bis zum Seitenrand reicht. Im mittleren Drittel zwei beide Decken kreuzende Querbänder welche auf den Seiten nach hinten umbiegen und im apikalen Drittel eine dreieckige Längsfigur umschreiben. Die Decken im apikalen Drittel kurz behaart. Unterseite der Vorder-, Mittel- und Hinterbrust zerstreut beschuppt, ebenfalls erstes und zweites Abdominalsternit. Schenkel mit einer Schuppenmakel unterseits nächst den Kniegelenken.

Männchen: Länge, 13 Millimeter (ohne Rüssel); Breite, 6. Weibchen: Länge, 14.5 Millimeter (ohne Rüssel); Breite, 6.6.

MINDANAO, Provinz Bukidnon, Lindabon (*W. Schultze*). Typen in meiner Sammlung.

Pachyrrhynchus regius sp. nov. Tafel 2, Fig. 6, ♀.

Dunkel glutrot glänzend, Flügeldecken mit grossen rundlichen gelblich grünen Schuppenringmakeln. In die Verwandtschaft von *P. speciosus* Waterhouse gehörig. Rüssel in der Apikalhälfte fein zerstreut punktiert, in der Mitte quer stufig abgesetzt, Basalhälfte mit kräftig ausgeprägtem bis zur Stirn reichendem Dorsaleindruck mit einer feinen Längsfurche in der Mitte. Der Eindruck auf der Stirn mit einer länglichen Schuppenmakel. Die Seitenkanten des Rüssels, nächst dem Dorsaleindruck wulstig hervortretend. Seiten des Rüssels unter der Fühlerfurche mit einem Fleck feiner gelblich grüner Härchen, Seiten des Kopfes unter dem Auge mit einer länglichen Schuppenmakel. Halsschild so lang wie breit, die Seiten schwach gerundet. Die Zeichnungsanlage sehr ähnlich der von *P. speciosus* Waterhouse jedoch breiter. In der Mitte, vom Hinterrand bis nahe zum Vorderrand reichend, zwei nach vorn wenig divergierende, dann zu einer Spitze sich vereinigende, Längsschuppenstreifen, die eine lanzett- oder pfeilförmige Figur bilden. Zwei breite Längsschuppenstreifen auf jeder Seite des Halsschildes, welche am Vorder- und Hinterrand verbunden sind und auf jeder Seite eine ungefähr länglich ovale Figur umschreiben. Flügeldecken länglicher in Form als *P. speciosus* Waterhouse, gereiht-punktiert. Jede Decke mit einer sehr grossen rundlichen Schuppenringmakel an der Basis, von der ersten Punktreihe bis zum

Seitenrand reichend. In der Mitte jeder Decke eine Querreihe von zwei etwas kleineren Ringmakeln und im Apikaldreieck eine grössere Ringmakel. Die in der Mitte am Seitenrand gelegene Ringmakel ist der im Apikaldreieck gelegenen, durch einen breiten Schuppenstreifen am Seitenrand, verbunden. Die beschuppten Stellen des Halsschildes und der Flügeldecken sind mehr oder weniger eingepresst oder vertieft. Unterseite, Vorder-, Mittel-, und Hinterbrust mehr oder weniger zerstreut beschuppt, erstes und zweites Abdominalsternit mit einer Schuppenmakel je seitlich. Schenkel mit einer kleinen Schuppenmakel unterseits nächst den Kniegelenken.

Männchen: Länge, 12.3 Millimeter (ohne Rüssel); Breite, 5.5.

Weibchen: Länge, 13 Millimeter (ohne Rüssel); Breite, 6.

LEYTE, von den Bergen in der Nähe des Dorfes Cabalian, im südlichsten Teil der Insel. Typen in meiner Sammlung.

Drei Exemplare dieser schönen Art erhielt ich durch die Güte des Herrn Dr. Albert W. C. T. Herre.

Pachyrrhynchus pseudoproteus sp. nov. Tafel 2, Fig. 2, ♂.

Kopf, Halsschild, und Beine glänzend schwarz, Flügeldecken matt, fein lederartig gerunzelt, mit blassgrünlichen Schuppenmakeln. Kopf, Rüssel in der Apikalhälfte zerstreut punktiert, Basalhälfte mit kräftigem Dorsaleindruck, die Seitenränder wulstig hervortretend, Stirn mit einer länglich ovalen Schuppenmakel, Seiten des Kopfes mit einer Längsschuppenmakel. Halsschild so lang wie breit, glänzend schwarz, glatt, mit einer kräftig ausgeprägten Furche nächst dem Hinterrande. In der Mitte auf der Scheibe zwei kleine keilförmige quergestellte Schuppenmakeln, Seiten mit je zwei ungefähr wellenförmigen Längsschuppenstreifen welche am Hinterrande zusammenlaufen. Flügeldecken gedrungen oval, schwach ausgeprägt gefurcht gereiht-punktiert, die Zwischenräume schwach gewölbt. Jede Decke mit drei Schuppenmakeln an der Basis, von welchen eine im dorsalen Teil und die am Seitenrand gelegene am grössten sind; in der Mitte eine querbandartige Doppelreihe von sechs grösseren Makeln, zwischen welchen sich einige kleine Schuppenpunkte befinden, sowie eine lange Randmakel; im apikalen Drittel drei querbandartig zusammenlaufende Makeln und ein Schuppenstreifen welcher das Spitzendreieck umschreibt. Unterseite, Mittel- und Hinterbrust sowie erstes Abdominalsegment mit einer Schuppenmakel je seitlich. Schenkel mit grosser Schuppenmakel nächst den Kniegelenken.

Männchen: Länge, 10.8 Millimeter (ohne Rüssel); Breite, 5.

LUZON, Provinz Laguna (*A. Worm*). Typus in meiner Sammlung.

Diese Art gehört in die Verwandtschaft von *P. multipunctatus* Waterhouse welche auf die Insel Bohol beschränkt zu sein scheint. Oberflächlich erinnert *P. pseudoproteus* etwas an *Metapocyrtus proteus* Heller.

Pachyrrhynchus semiignitus sp. nov. Tafel 2, Fig. 9, ♂.

Kopf und Halsschild glänzend glutrot, Flügeldecken und Beine metallisch kupferig glänzend. Decken mit blassgrünen Schuppenmakeln und Streifen. Rüssel in der Apikalhälfte kräftig zerstreut punktiert, Basalhälfte mit stark ausgeprägtem Dorsaleindruck, einen kleinen Schuppenschwarm tragend. Die Seitenränder des Eindruckes wulstig aufgeworfen. Halsschild etwas breiter wie lang, die Seiten mässig gerundet. Eine feine Schuppenlinie am Vorder- sowie am Hinterrande, auf den Seiten, über den Vorderhüften durch einen makelartig erweiterten Längsstreifen verbunden. Flügeldecken gereiht-punktiert; jede Decke im basalen Drittel mit einer Querreihe von vier grösseren länglichen Schuppenmakeln, zwischen denen einige kleine Schuppenpunkte stehen; im apikalen Drittel, zwischen der zweiten und dritten Punktreihe ein Längsschuppenstreifen welcher sich nächst der Apex mit einem kurzen Seitenrandstreifen verbindet, auf diese Art eine V-förmige oder dreieckige Figur bildend. Innerhalb dieses Dreieckes, zwei eine Querreihe bildende, kleine Schuppenmakeln. Unterseite kupferig glänzend, Mittelbrust zerstreut beschuppt und mit einer grossen Makel je seitlich, ebenfalls die Hinterbrust. Schenkel mit einem kleinen Schuppenschwarm auf der Unterseite nächst den Kniegelenken.

Männchen: Länge, 11.5 Millimeter (ohne Rüssel); Breite, 5.6.

MINDANAO, Provinz Cotabato, Pikit. Typus in meiner Sammlung.

Pseudapocyrtus apicatus sp. nov. Tafel 1, Fig. 7, ♀.

Kopf, Halsschild, und Beine schwarz, Flügeldecken kastanienbraun mit kremfarbigen Schuppenflecken. In Körperform dem *P. imitator* Heller[6] am ähnlichsten. Rüssel schwach gewölbt, dicht punktiert, an der Basis durch eine gebogene Querfurche von der Stirn abgesetzt. Letztere zerstreut punktiert, mit einer Mittellängsfurche und einem Schuppenfleck. Halsschild länger wie breit, kräftig quergerunzelt mit einer undeutlichen Mittellängsfurche. Je seitlich der Mitte ein nicht sehr

[6] Philip. Journ. Sci. § D 7 (1912) 329, Taf. 2, Fig. 2.

dicht beschuppter Längsstreifen vom Vorder- bis zum Hinterrand reichend. Ein anderer breiterer Schuppenstreifen auf den Seiten über den Vorderhüften. Flügeldecken schwach glänzend unregelmässig gereiht-punktiert. Jede Decke mit sieben grösseren Schuppenflecken, einer an der Basis, fünf im mittleren Teil der Decke wovon zwei am Aussenrand liegen, und ein grosser dreieckiger Schuppenfleck an der apikalen Verjüngung der Decke. Der Seitenrand an der Apex mit einem kleinen rundlichen Ausschnitt, die Nahtenden in eine gemeinsame, nach unten gebogene, schnabelartige Spitze auslaufend. Unterseite, Mittel- und Hinterbrust je seitlich mit einem Schuppenfleck. Letztes Abdominalsegment mit einem gebogenen Ausschnitt. Hinterschenkel die Deckenspitze nicht überragend.

Weibchen: Länge, 10.5 Millimeter (ohne Rüssel); Breite, 4.5.

LUZON, Provinz Bontoc (*W. Schultze*). Typus in meiner Sammlung.

Pseudapocyrtus catanduanensis sp. nov. Tafel 2, Fig. 7, ♀.

Schwarz; Fühlerschaft, Halsschildoberseite, und Beine rot mit Ausnahme der Schenkelspitzen und Tarsenglieder welche ebenfalls schwarz sind. Nahe verwandt mit *P. formicarius* Heller. Rüssel zerstreut punktiert, der Länge nach schwach gewölbt, mit einer kräftigen Mittellängsfurche welche vor der Stirn in einem punktförmigen Eindruck endet. Halsschild kugelig, so lang wie breit, mit einer Vorder- und Hinterrandfurche; der von letzteren abgeschnürte, etwas gewulstete Vorder- und Hinterrand schwarz; Oberseite rot, abgeschliffen gekörnelt, und mit kräftiger Mittellängsfurche. Halsschild relativ kleiner als bei *P. formicarius* Heller. Flügeldecken beim Männchen $1\frac{1}{5}$ mal so lang wie breit, kräftig gewölbt, kurz eiförmig, im apikalen Drittel nach der Apex zu verjüngt und verrundet; beim Weibchen $1\frac{1}{2}$ mal so lang wie breit, für zwei Drittel der Länge kräftig gewölbt, dann plötzlich seitlich scharf abgeschnürt, der apikale Teil der Decken seitlich zusammengedrückt einen nasenähnlichen Vorsprung bildend. Apex an der Naht mit dreieckigem Ausschnitt, am Seitenrand mit schwach gebogenem Ausschnitt, so dass die Deckenspitzen von der Seite gesehen eine scharf gebogene, schnabelartige Form haben. Die Decken sehr grob, tief und regelmässig gereiht-punktiert, etwas gröber als bei obiger Art. Hinterschenkel beim Weibchen die Deckenspitzen nicht, beim Männchen weit überragend.

Männchen: Länge, 10 Millimeter (ohne Rüssel); Breite, 4.5.
Weibchen: Länge, 11 Millimeter (ohne Rüssel); Breite, 5.

CATANDUANES, Virac (*W. Schultze*). Typen in meiner Sammlung.

Diese Art unterscheidet sich besonders beim Weibchen von *P. formicarius* Heller dadurch dass der apikale Teil der Flügeldecken bei letzterer Art breiter, seitlich nicht so stark abgeschnürt and zusammengedrückt ist. *P. formicarius* Heller die mir nur von der Insel Polillo vorliegt ist nach einem männlichen Exemplar beschrieben.

Die Gattungen *Pseudapocyrtus* Heller und *Apocyrtus* Erichson sind sehr nahe mit einander verwandt, wie auch die Penisformen von *P. catanduanensis* sp. nov. (Tafel 4, Fig. 12) und *P. formicarius* Heller [7] (Tafel 4, Fig. 13) sowie *A. inflatus* Erichson (Tafel 4, Fig. 14) zeigen.

Metapocyrtus (Artapocyrtus) octomaculatus sp. nov. Tafel 1, Fig. 10, ♂.

Glänzend schwarz, jede Flügeldecke mit vier blass rosafarbigen Schuppenflecken (Männchen). Nahe verwandt mit *A. sexmaculatus* Schultze und *quadriplagiatus* Roelofs, der letzteren Art am nächsten stehend. Rüssel gewölbt, an der Basis durch eine breite Querfurche scharf abgesetzt und mit einer Mittellängsfurche welche bis zur Stirn reicht. Rüsselunterseite mit kräftigerem, nach hinten gerichtetem Zapfen als *A. quadriplagiatus* Roelofs. Halsschild so lang wie breit, zerstreut punktiert, mit einem Schuppenstreifen am Vorder- und am Hinterrand, beide an den Seiten durch einen Schuppenstreifen verbunden. Flügeldecken kräftig unregelmässig gereiht-punktiert, nicht so dicht als bei letztgenannter Art. Jede Decke im basalen Drittel mit zwei eine Querreihe bildenden Schuppenmakeln und zwei weiteren Makeln am apikalen Drittel.

Männchen: Länge, 11 Millimeter (ohne Rüssel); Breite, 4.7.

POLILLO (*W. Schultze*). Typus in meiner Sammlung.

Diese Art scheint auf obigen Fundort beschränkt su sein.

Artapocyrtus quadriplagiatus Roelofs erhielt ich von Luzon, Provinz Laguna, Umgebung vom Dorf Paete, und *A. sexmaculatus* Schultze nur von Virac auf den Catanduanes Inseln. Auf Grund langjähriger Beobachtungen möchte ich bemerken dass alle Arten der philippinischen Pachyrrhynchiden in ihrem Verbreitungsgebiet sehr beschränkt sind; fast alle Arten treten äusserst lokal auf. Zu obiger Untergattung *Artapocyrtus* gehören ausser den von Heller [8] angeführten Arten noch die folgen-

[7] Philip. Journ. Sci. § D 7 (1912) 327, Taf. 2, Fig. 1.
[8] Philip. Journ. Sci. § D 7 (1912) 338.

den: *A. panayensis* Schultze, von der Insel Panay; *A. bucasanus* Schultze von der Insel Bucas Grande; und *A. violaceus* Schultze von der Insel Siargao. Letztere Art hält Prof. Heller [9] für identisch mit der alten von Cuming [10] gesammelten Art *A. bifasciatus* Waterhouse.[11] Aus der Baker'schen Sammlung erhielt ich von Heller bestimmte Exemplare von *A. bifasciatus* Waterhouse welche aus Mindanao, Provinz Agusan, Butuan, stammen und welche ich auch der Beschreibung nach als diese Art bestimmte. Diese Art unterscheidet sich durch die viel schwächer ausgeprägte Skulptur des Halsschildes und Punktierung der Flügeldecken, sowie der blassgrünen oder goldiggrünen Beschuppung der Querbinden, sehr deutlich von *A. violaceus* Schultze, bei welcher Art die Binden violettbläulich beschuppt sind und welche auf die Insel Siargao beschränkt ist.

Metapocyrtus (Metapocyrtus) lindabonus sp. nov. Tafel 1, Fig. 12, ♂.

Schwarz glänzend, Halsschild mit grossen ovalen bläulichgrünen Längsschuppenmakeln, Flügeldecken mit breiten Schuppenquerbändern. Rüssel dicht verworren punktiert, an der Basis durch eine Querfurche abgesetzt und mit einer Mittellängsfurche welche bis zur Stirn reicht. Rüssel mit einigen zerstreuten Schuppen, Stirn mit kleinem, makelartigen Schuppenschwarm. Halsschild so lang wie breit, undeutlich zerstreut punktiert und fein gerunzelt, am Vorderrand ein schmaler Schuppenstreifen welcher mit einer grossen Schuppenmakel auf den Seiten, über den Vorderhüften, zusammenläuft. Je seitlich der Mitte eine grosse ovale Längsschuppenmakel. Flügeldecken beim Männchen länglich oval, beim Weibchen gedrungen oval, die grösste Breite etwas vor der Mitte, weitläufig zerstreut, ziemlich grob punktiert. Jede Decke mit drei querbandartigen bläulichgrün metallischen Schuppenflächen welche durch einen Kahlstreifen längs der Naht und durch zwei schmale Kahlquerbänder von einander getrennt sind. Beim Weibchen ist das Schuppenquerband der Basis schmäler als beim Männchen und gleichbreit wie der erste Querkahlstreifen, das mittlere Querband hat beim Weibchen im dorsalen Teil der Decke eine Makel abgeteilt, ebenfalls ist die beschuppte Fläche in der Apikalhälfte der Decke bei Letzterem teilweise in Makeln aufgelöst.

[9] Entomolog. Mitteil. 10 (1921) 197.

[10] Cuming sammelte auf der Hauptinsel Mindanao speciell in der Provinz Misamis. Siehe ebenfalls Philip. Journ. Sci. § C 10 (1915) 183.

[11] Ann. & Mag. Nat. Hist. 7 (1841) 226, 9 (1842) 307.

Unterseite, Mittelbrust je seitlich, mit einer Schuppenmakel. Beine schwarz, fein greis behaart.

Männchen: Länge, 13 Millimeter (ohne Rüssel); Breite, 5. Weibchen: Länge, 13.5 Millimeter (ohne Rüssel); Breite, 6.

MINDANAO, Provinz Bukidnon, Lindabon (*W. Schultze*). Typen in meiner Sammlung.

Metapocyrtus (Metapocyrtus) atocanus sp. nov. Tafel 1, Fig. 9, ♂.

Schwarz, Flügeldecken mit gleichbreiten schwarzen und metallisch grünen Schuppenlängsstreifen. Rüssel dicht und gleichmässig verworren punktiert, mit einem flachen beschuppten Eindruck, an der Basis durch eine Querfurche abgesetzt, Stirn mit einer kurzen Mittellängsfurche und einem Schuppenfleck. Halsschild breiter wie lang, die Seiten kräftig gewölbt, auf der Scheibe abgeflacht, grob verworren zusammenlaufend punktiert mit einem etwas schwach punktierten Streifen auf der Scheibe in der Mitte. Am Vorderrand ein Schuppenstreifen welcher sich mit einem Längsstreifen auf den Seiten über den Vorderhüften verbindet, ein anderer gekrümmter Schuppenlängsstreifen je seitlich der Mitte. Diese Schuppenstreifen umschreiben eine grosse Kahlmakel auf den Seiten des Halsschildes und eine grössere auf der Scheibe. Flügeldecken oval, beim Weibchen der apikale Deckenabsturz an der Naht steiler als beim Männchen, die Naht etwas geschwollen hervortretend, greis behaart und in zwei kurzen stumpfen Spitzen endend; beim Männchen verrundet. Jede Decke mit neun glatten schwarzen Längsschwielen die gleichbreit sind wie die furchenartigen punktierten und dicht beschuppten längsstreifenartigen Zwischenräume. Unterseite schwarz, Mittelbrust in der Mitte dicht hell bräunlich behaart, besonders beim Männchen.

Männchen: Länge, 8.8 Millimeter (ohne Rüssel); Breite, 3.2. Weibchen; Länge, 9.8 Millimeter (ohne Rüssel); Breite, 4.

LUZON, Provinz Benguet, im Thale nach dem Igorotendorfe Atoc (*W. Schultze*). Typen in meiner Sammlung.

Metapocyrtus (Metapocyrtus) sumptuosus sp. nov. Tafel 1, Fig. 4, ♂.

Schwarz, Halsschild mit goldig beschuppter Querbinde, Flügeldecken mit schmalen goldigen Längsschuppenstreifen, die vor und hinter der Mitte durch zwei Kahlquerbinden unterbrochen sind. Rüssel in der Apikalhälfte dicht und gleichmässig punktiert sowie der Länge nach gewölbt, in der Mitte durch eine Querfurche abgesetzt. Eine unregelmässige Längsfurche bis zur Stirn reichend, welche goldig beschuppt ist. Stirn grob

zerstreut punktiert. Halsschild etwas breiter wie lang, sehr grob und zusammenlaufend punktiert, mit einer schmalen Schuppenbinde am Vorderrand und einer anderen Querbinde etwas hinter der Mitte; beide Binden laufen auf den Seiten in eine grosse Makel zusammen. Flügeldecken kurz oval, beim Weibchen in kurze, stumpfe, etwas nach oben gebogene Spitzen auslaufend. Die Decken reihenförmig unregelmässig grob punktiert, die Spatien sind im basalen sowie im apikalen Drittel leistenartig vortretend, die etwas furchenartigen Punktreihen goldig beschuppt. Etwas vor und etwas hinter der Mitte eine Querkahlbinde; beim Weibchen ist die vordere Kahlbinde im dorsalen Teil nach der Basis zu bedeutend erweitert. Unterseite und Beine spärlich weisslich behaart. Hinterschenkel des Männchens wie bei allen Arten dieser Gattung, die Deckenspitze überragend.

Männchen: Länge, 11.5 Millimeter (ohne Rüssel); Breite, 5. Weibchen: Länge, 12 Millimeter; Breite, 5.

LUZON, Provinz Ilocos Norte, Berg Palimlim (*W. Schultze*). Typen in meiner Sammlung.

Unter dem Material obiger Art vom selben Fundort befinden sich eine Anzahl Stücke die erheblich abweichen.

Metapocyrtus sumptuosus var. aureatus var. nov.

Halsschild, mit Ausnahme einer Kahlquerbinde vor der Mitte, zerstreut goldig beschuppt. Flügeldecken ohne Kahlquerbinden, die rippen- oder leistenartigen Spatien gleichmässig ausgeprägt, die furchenartigen Punktreihen gleichmässig goldig beschuppt, so das eine alternierende schwarz-goldige Längsstreifenzeichnung entsteht.

Metapocyrtus sumptuosus gehört in die Verwandschaft von *M. virgatus* Heller, welche jedoch schlanker gebaut ist. Diese Art erhielt ich in Anzahl von der Insel Panay, Culasi (*R. C. McGregor*). Die Art ist beschrieben nach einem Männchen von der Insel Negros. Das Weibchen hat die Apikalenden der Decken ebenfalls, in jedoch ganz kurze gedrungene, stumpfe Spitzen auslaufend.

Metapocyrtus (Metapocyrtus) interruptostriatus sp. nov. Tafel 2, Fig. 4, ♂.

Schwarz, glänzend, Halsschild und Flügeldecken mit feinen blassgrünen Schuppenlängslinien; verwandt mit *M. pseudomonilifer* Heller und *interruptolineatus* Heller. Rüssel kräftig verworren punktiert, nach der Apex zu stark divergierend, die Seitenränder schwielig hervortretend, ein dreieckiger Eindruck

in der Basalhälfte, sowie eine Mittellängsfurche welche bis zur Stirn reicht. Letztere zerstreut punktiert und mit einem kleinen makelartigen Schuppenschwarm welcher durch die Furche geteilt wird. Halsschild so lang wie breit, mit scharf ausgeprägter Furche nächst dem Vorder- und Hinterrande, sowie mit Mittellängsfurche, welche jedoch vor der Hinterrandfurche endet. Ein schmaler Schuppenstreifen am Vorderrand und eine feine abgekürzte Längsschuppenlinie, je seitlich der Mitte, nächst dem Hinterrande, sowie ein kleiner bläulicher Schuppenschwarm auf den Seiten über den Vorderhüften. Flügeldecken fein zerstreut punktiert, beim Männchen an der Apex verrundet, beim Weibchen schwach tuberkelartig geschwollen, im basalen und apikalen Drittel mit abgekürzten blassgrünen Schuppenlinien welche furchenartig ausgeprägt sind. Diese rudimentären Schuppenlinien befinden sich an der Stelle der zweiten, vierten, und sechsten Punktreihe, die achte Schuppenlinie ist durchgehend erhalten und reicht bis zur Apex, um sich dort mit der zweiten rudimentären Schuppenlinie zu verbinden. Diese zweite Schuppenlinie ist im apikalen Drittel gegabelt indem eine kurze Fortsetzung der vierten Schuppenlinie mit ihr zusammenläuft. Die Schuppenlinien sind beim Weibchen stärker erhalten als beim Männchen. Unterseite; der mittlere Teil der Hinterbrust und des ersten Abdominalsegmentes nur beim Männchen kräftig quergerunzelt und dicht bräunlich behaart.

Männchen: Länge, 12 Millimeter (ohne Rüssel); Breite, 5.3. Weibchen: Länge, 10.5 Millimeter (ohne Rüssel); Breite, 4.8.

LUZON, Provinz Benguet, Berg Santo Tomas (*W. Schultze*). Typen in meiner Sammlung.

Bei den Männchen dieser und den oben angeführten Arten ist das Halsschild relativ bedeutend grösser als bei den Weibchen. *Metapocyrtus interruptolineatus* Heller sammelte ich in Luzon, Benguet, in der Nähe des Dorfes Atoc; *M. pseudomonilifer* Heller erwarb ich im Tausch, ohne genauen Fundort.

Homalocyrtus maculatus sp. nov. Tafel 1, Fig. 13, ♂.

Dunkelbraun, Flügeldecken mit goldigen Schuppenmakeln, am nächsten verwandt mit *H. tumidosus* Heller. Rüssel in der Mitte mit einer scharf ausgeprägten Querfurche, die apikale Hälfte sehr dicht zusammenlaufend punktiert und nach vorn zu stärker divergierend als bei obiger Art. Die Basalhälfte mit einer scharf ausgeprägten Mittellängsfurche; Stirn mit wenigen zerstreuten goldigen Schuppen. Halsschild länger wie breit, gleichmässig perlig gekörnelt mit einer undeutlichen Mittelfurche. In der Mitte je seitlich eine kleine Schuppenmakel und auf den

Seiten über den Vorderhüften ein grösserer Schuppenschwarm, sowie ein schmaler Schuppenstreifen am Vorderrand. Flügeldecken gleichmässig dicht und zusammenlaufend gereiht-punktiert; die Skulptur ist glatter als bei *H. tumidosus* Heller. An der Basis ein grösserer makelartiger Schuppenschwarm welcher sich längs dem Seitenrande bis zum apikalen Drittel der Decken fortsetzt und dort in einige unregelmässige Makeln aufgelöst ist. In der Mitte jeder Decke drei eine Querreihe bildende Makeln. An der Naht, im apikalen Drittel (Männchen), eine makelartig beschuppte und fein beborstete schwache Schwellung.

Männchen: Länge, 11 Millimeter; Breite, 5.5.

Panaon (*G. Boettcher*). Leyte, aus den Bergen in der Nähe vom Dorfe Cabalian, im Süden der Insel erhielt ich eine grosse Anzahl von Exemplaren. Typus in meiner Sammlung.

CELEUTHETINÆ

Neopyrgops panayensis sp. nov. Tafel 1, Fig. 11.

Schwarz; Halsschild und Flügeldecken mit hellblauen Schuppenmakeln. In Körperform gedrungener gebaut wie *N. banksi* Heller, sowie die schwarze Beborstung viel dichter und länger. Rüssel auf der Dorsalseite kräftig der Länge nach gewölbt, grob verworren punktiert, mit zwei äusserst stark entwickelten Längsleisten, zwischen welchen sich eine breite Längsfurche befindet. Der aufgetriebene Teil des Rüssels vor der Stirn durch eine bogenförmige Furche scharf abgesetzt. Seiten des Rüssels mit einem Schuppenfleck. Fühler hellblau beschuppt und kurz schwarz beborstet. Halsschild länger wie breit, sehr grob und zusammenlaufend punktiert, die Zwischenräume gekörnt hervortretend, besonders auf den Seiten. Ein kleiner dreieckiger Schuppenfleck je seitlich der Mitte am Vorder- sowie am Hinterrande und eine grosse Schuppenmakel auf den Seiten über den Vorderhüften. Flügeldecken sehr kurz gedrungen oval, ungefähr ein Sechstel länger wie breit; grob gereiht-punktiert. Die ziemlich hervortretenden leistenartigen Zwischenräume raspelartig gekörnt und beborstet. Jede Decke, an der Basis mit einer länglichen Nahtmakel und einer anderen am Seitenrand. Etwas vor der Mitte, und nach den Seiten zu schräg nach vorn gerichtet, eine Querreihe von drei bis vier Schuppenmakeln. Im letzten Drittel eine weitere Querreihe von drei bis vier Makeln welche nach dem Seitenrande zu mehr oder weniger zusammenlaufen und sich mit einem Seitenrandstreifen verbinden, welcher bis zur Apex reicht und dort wiederum mit

einem kurzen Nahtstreifen zusammenfliesst. Unterseite, Mittel- und Hinterbrust, sowie erstes Abdominalsegment seitlich beschuppt, im Uebrigen raspelkörnig punktiert und fein beborstet. Schenkel mit einer breiten Binde nächst der Wurzel und vor der Spitze; Schienen und Tarsen mehr oder weniger hellblau beschuppt und fein beborstet.

Männchen: Länge, 11 Millimeter (ohne Rüssel); Breite, 5.8. Weibchen: Länge, 12.5 Millimeter (ohne Rüssel); Breite, 6.3.

PANAY, Jamindan (*W. Schultze*). Typen in meiner Sammlung.

Die hellblaue Färbung der Schuppen in dieser Art ist bei älteren Exemplaren meist hell blassgrün.

ALCIDINÆ

Alcides (Metallalcides) butuanensis sp. nov. Tafel 2, Fig. 10.

Kopf, Flügeldecken, und Beine kupferig glänzend pechbraun, Halsschild grünlich glänzend. Halsschild und Flügeldecken mit blassgelben Tomentmakeln, die Tomentierung der Makeln ist dicht und lang. Rüssel dicht und verworren punktiert auf dem Rücken mit einer glatten Schwiele. Kopf dicht und fein punktiert, mit einem tiefen Eindruck auf der Stirn. Halsschild raspelartig zerstreut punktiert mit einer glatten Mittellängslinie. Je seitlich am Vorderrand eine schmale Quermakel, eine andere grössere je seitlich am Hinterrand und eine kleine runde Makel in der Mitte über dem Schildchen. Flügeldecken regelmässig tief gereiht-punktiert. Jede Decke mit fünf Tomentmakeln, eine grosse runde Makel an der Basis von der ersten bis zur vierten Punktreihe reichend, eine grosse Quermakel in der Mitte, und eine kleine Makel am Seitenrand sowie zwei Makeln im apikalen Drittel, von welchen eine länglich keilförmige sich zwischen der ersten und dritten Punktreihe befindet. Unterseite der Vorderbrust tomentiert, Mittelbrust je seitlich mit einer Tomentmakel, Hinterbrust querbandartig tomentiert, jedoch in der Mitte unterbrochen. Abdominalsegmente lederartig gerunzelt, zweites bis viertes Segment nach den Seiten zu stärker, in der Mitte schwächer tomentiert. Beim Weibchen ist die Grundfärbung blauschwarz, nur das Halsschild grünlich glänzend.

Männchen: Länge, 8 Millimeter; Breite, 3.5. Weibchen: Länge, 10 Millimeter; Breite, 4.3.

MINDANAO, Provinz Agusan, Butuan (*C. F. Baker*). Typen in meiner Sammlung; Cotypen No. 16996 in der Sammlung von Prof. C. F. Baker.

Alcides (Metallalcides) gubatanus[12] **sp. nov.**

Dunkelblau glänzend, Halsschild und Flügeldecken mit kremfarbigen Tomentmakeln. In Körperform und Grösse *A. butuanensis* Schultze sehr ähnlich. Rüsselseiten nach der Basis zu dicht und grob zerstreut punktiert, Stirn mit einer punktförmigen Impression. Kopf fein und dicht punktiert. Halsschild zerstreut raspelkörnig punktiert, im vorderen Teil seitlich eingeschnürt. Je seitlich der Mitte nächst dem Vorderrande mit einer kleinen queren Tomentmakel, einer anderen, dreieckigen, mit der Spitze nach dem Schildchen gerichteten, Tomentmakel in der Mitte am Hinterrand, und eine grössere Quermakel auf den Seiten am Hinterrand. Flügeldecken, die grösste Breite zwischen den Schulterbeulen; mit regelmässigen kräftig ausgeprägten Punktreihen, die Punkte länglich. Jede Decke mit drei Tomentmakeln; zwei bilden eine Querreihe in der Mitte, von welchen die an der Naht gelegene kleiner und mehr rundlich ist; und eine grosse breit hakenförmige Makel im apikalen Viertel. Unterseite der Vorderbrust mit einem Quertomentstreifen nächst dem Vorderrande, Mittel- und Hinterbrust mit einer Tomentmakel je seitlich. Zweites bis viertes Abdominalsternit nahezu ganz kremweiss tomentiert. Analsternit äusserst dicht narbig punktiert.

Länge, 9.3 Millimeter (ohne Rüssel); Schulterbreite, 4.

MINDORO, Pinamalayan (*A. Duyag*). Typus in meiner Sammlung.

Alcides (Metallalcides) mangyanicus[13] **sp. nov.**

Rüssel, Kopf, und Beine dunkel blau, glänzend; Halsschild und Flügeldecken einfarbig dunkel bläulich grün, metallisch glänzend. In Körperform und Grösse dem *A. semperi* Pascoe sehr ähnlich. Rüssel fein zerstreut punktiert, Stirn mit einem kleinen dreieckigen Eindruck. Antenna schwarz mit Ausnahme der grau pubeszierten Keulenglieder. Halsschild, seitlich nächst dem Vorderrande kräftig eingeschnürt; sehr grob und tief und ziemlich dicht zerstreut punktiert, nächst dem Vorderrande ist die Punktierung feiner, nach den Seiten zu dichter und gröber, teilweise zusammenlaufend. Flügeldecken, die grösste Breite zwischen den Schulterbeulen; mit nicht sehr kräftigen, aber regelmässigen Punktreihen, die Zwischenräume

[12] "Gubat" bedeutet dichter wilder Gebirgswald in der Mangyanes und Tagaler Sprache.

[13] Die Mangyanes, ein nur auf die Insel Mindoro beschränkter Philippiner Volkstamm.

fein zerstreut punktiert und fein chagriniert. Unterseite der Mittelbrust fein und dicht graubraun pubesziert, jedoch in der Mitte, nach dem Hinterrande zu in dreieckiger Form kahl, fein punktiert und quer gerunzelt. Erstes Abdominalsternit seitlich ebenfalls fein pubesziert.

Länge, 14.5 Millimeter (ohne Rüssel) ; Schulterbreite, 6.5.

MINDORO, Pinamalayan (*M. Ramos*). Typus in meiner Sammlung.

CALANDRINÆ

Eugithopus uhlemanni sp. nov. Tafel 1, Fig. 1 und 2.

Kremweiss; Halsschild und Flügeldecken mit schwarzen Längsstreifen und Makeln. Rüssel stark gebogen, auf dem Rücken mit einer nach der Stirn zu divergierenden schwarzen Längsschwiele, Rüsselseiten mit einer schmäleren Längsschwiele welche an der Fühlergrube endet. Stirn mit einem tiefen länglichen Grübchen. Unterseite und apikaler Teil des Rüssels ebenfalls schwarz. Fühler, zweites Geisselglied am längsten. Das schwarze becherförmige Endglied an der Spitze weiss. Halsschild in der Mitte mit einem breiten schwarzen Längsstreifen und je seitlich ein schmälerer Streifen vom Vorderbis zum Hinterrand reichend. Seiten mit einer länglichen schwarzen Makel. Die kremweissen Flächen weitläufig zerstreut punktiert, die schwarzen Flächen dichter punktiert. Flügeldecken je mit neun scharf eingerissenen, feinen Längsfurchen. Zwischen der ersten und dritten Furche, ein an der Basis und Apex verkürzter, schwarzer Längsstreifen. Nächst der Basis eine schwarze Makel zwischen der dritten und sechsten Furche. Ein weiterer Längsstreifen, welcher in der Mitte und nächst der Apex makelartig erweitert ist, zwischen der fünften und neunten Furche. Pygidium grob zerstreut punktiert, mit einer schwarzen Makel in der Mitte und einer kurz beborsteten Mittellängsschwiele. Unterseite der Vorder-, Mittel-, und Hinterbrust weitläufig zerstreut punktiert, ebenfalls die Abdominalsegmente, nur das Letzte sehr grob punktiert. Schenkel narbig punktiert, Schienen an der Unterseite kurz bebürstet. Die Apikalhälfte des Klauengliedes schwarz.

Länge, 24.5 Millimeter (ohne Rüssel) ; Breite, 9.

MINDANAO, Provinz Surigao, Surigao (*W. Schultze*). Typus in meiner Sammlung.

Von den anderen philippinischen Arten dieser Gattung (*E. elegans* Roelofs, *ochreatus* Eydoux et Souleyet, *ornatus* und *plagiatus* Roelofs) unterscheidet sich diese Art schon durch

die Grösse, sowie durch die kremweisse und schwarze Zeichnung. Diese schöne Art widme ich dem Andenken von Herrn R. Uhlemann, dem früheren Vorsitzenden des Leipziger Entomologischen Vereins "Iris," Leipzig.

UNTERSUCHUNGEN ÜBER DIE PENISFORMEN VON PACHYRRHYNCHINEN (CURCULIONIDÆ)

Zu den vergleichenden Untersuchungen über die Penisstruktur von Pachyrrhynchinen, konnte ich 27 Arten der Gattung *Pachyrrhynchus;* 3 Arten von *Metapocyrtus;* 1 ausser-philippinische Gattung und Art *Pantorhytes;* 3 Arten von *Homalocyrtus;* und 2 Arten von *Macrocyrtus* heranziehen.

In Bezug auf die Präparation des in Betracht kommenden Organs möchte ich erwähnen, da ja alle Arten dieser Käfergruppe äusserst hart sind, dass ich in folgender Weise vorging. Mittels einer feinen, dreikantig spitz angeschliffenen Seziernadel bohrte ich in der Kerbung zwischen dem ersten und zweiten Abdominalsternit an zwei oder drei Stellen ein, drückte die Sternite, welche in einem Stück zusammenhängen, leicht ein und hob dieselben dann heraus. Mittels einer feinen gebogenen Pincette kann man dann den Penis fassen und herausziehen. Darauf weichte ich dieses Organ mit den in getrockneten Käfern dasselbe fest umgebenden Häuten in Wasser, und lösste dieselben mit der Nadel leicht ab, da es mir bei den Untersuchungen nur auf Vergleiche der allgemeinen Penisformen an sich ankam, um dieselben eventuell als Hülfsmittel in der Bestimmung zu benutzen, sowie zur Feststellung des verwandtschaftlichen Verhältnisses von Gattungen und Arten unter sich. Der Penis dieser Curculioniden ist ein hartes, langes, röhrenförmiges, in der Seitenansicht meist gebogenes, stark chitinisiertes Organ, in der Färbung, je nach der Art, hell transparent bräunlich bis dunkelkastanienbraun oder nahezu schwarz. Wie ich feststellen konnte zeigt der Penis der verschiedenen Arten, in den äusserlichen Formen, besonders in Bezug auf Länge, Form der Spitze, Krümmung, und Form des Mündungshofes; der Austrittsstelle des Ductus ejaculatorius; zum Teil sehr scharf ausgeprägte Artmerkmale. Als Oberseite, natürlich die den Decken zugekehrte Seite, bezeichne ich in allen Abbildungen die Seite des Mündungshofes. Die Seitenansicht aller Figuren (rechts) hat die Mündungshofseite der Oberseitenfigur zugekehrt.

Die Form des Penis ist (siehe Seitenansichten) in seinen Krümmungen an die Form und Wölbung des Abdomens und Flügeldecken besonders der apikalen Termination des letzteren

angepasst, ebenfalls unter gewisser Anpassung an die Form der Flügeldecken des Weibchens, welche in den meisten Arten mehr oder weniger von der des Männchens verschieden ist.

Zum Beispiel, alle *Pachyrrhynchus*-Arten haben kräftig gewölbte Flügeldecken, die Penisformen sind demgemäss alle gekrümmt, im Gegensatz zu den Arten der Gattung *Macrocyrtus* welche mehr abgeflachte Flügeldecken besitzen bei denen die Penisform (Tafel 4, Fig. 18 und 19), langgestreckt und kaum gekrümmt ist. Gewisse Arten die äusserlich grosse Aehnlichkeit haben, zum Beispiel *Pachyrryhnchus apicatus* (Tafel 3, Fig. 1) und *venustus* (Tafel 3, Fig. 2) oder *P. pinorum, dubiosus, tristis* (Tafel 3, Fig. 3, 4, 5) oder *P. monilifer, orbifer, rugicollis* (Tafel 3, Fig. 16, 17, 18) oder *P. igorota, gloriosus, inclytus, pulchellus* (Tafel 4, Fig. 1, 2, 3, 4) zeigen auch in den Penisformen grosse Aehnlichkeit und bestätigen das verwandtschaftliche Verhältniss. Wiederum andere, äusserlich ähnliche Arten, zum Beispiel, *P. venustus* und *virgatus* (Tafel 3, Fig. 2 und 7), oder *P. decussatus, phaleratus, halconensis* (Tafel 3, Fig. 12, 13, 14) zeigen in den Penisformen wesentliche Unterschiede.

Noch andere Arten, die auch äusserlich in Bezug auf Form, Skulptur, und Zeichnung isoliert stehen, zeigen auch in der Form des obigen Organs besondere Abweichungen, zum Beispiel, *P. ochroplagiatus, sumptuosus, argus* (Tafel 3, Fig. 6, 11, 15) von den anderen Arten. Auf Grund des allerdings lückenhaften Materials, scheint die ausserphilippinische Gattung *Pantorhytes* (Tafel 4, Fig. 11) der Gattung *Pachyrryhnchus* (Tafel 3, Fig. 1 bis 20, Tafel 4, Fig. 1 bis 7) am Nächsten zu stehen. Dieser Letzteren sehr nahe verwandt ist auch die Gattung *Metapocyrtus* (Tafel 4, Fig. 8, 9, 10), jedoch mit Aussnahme der Subgattung *Homalocyrtus*.[14] Arten der Letzteren sind äusserlich auch in der Bauart verschieden, besonders aber im männlichen Geschlecht sind die Flügeldecken im dorsalen Teil mehr abgeflacht und bis zum zweiten Drittel ihrer Länge stark divergierend, verbreitert, dagegen beim weiblichen Geschlecht gleichmässiger gewölbt und schlanker gebaut. Aus diesem Grunde, besonders aber durch die eigentümliche Penisform, die sich ganz bedeutend von allen anderen untersuchten Gattungen unterscheidet, ist *Homalocyrtus* als selbstständige Gattung anzuerkennen. Da auch die Artbestimmung innerhalb dieser Gattung eine ziemlich

[14] An dieser Stelle möchte ich einen Fehler korregieren der gemacht wurde, ehe ich die Penisuntersuchungen vornahm; die breiten Stücke von *Homalocyrtus*-Arten sah ich als die Weibchen an, jedoch sind dieselben Männchen, vergl. Philip. Journ. Sci. 15 (1919) 554.

schwierige ist, so sind doch an den Penisformen von *H. conicus, intermittens, maculatus* (Tafel 4, Fig. 15, 16, 17) ausgeprägte Artunterschiede zu erkennen. Besonders merkwürdig sind auch die hakenförmigen, mit der Oberseite nach oben gekrümmten Penisformen der Gattungen *Pseudapocyrtus* und *Apocyrtus*, als Beispiele, *P. catanduanensis* und *formicarius* (Tafel 4, Fig. 12 und 13) sowie *A. inflatus* (Tafel 4, Fig. 14). Weit verschieden von den *Pachyrrhynchus* Penisformen sind auch die an der Spitze schräg abgestutzten federkielartigen Formen von *Macrocyrtus erosus* und *subcostatus* (Tafel 4, Fig. 18 und 19). Jedenfalls zeigen diese Untersuchungen deutlich wie ratsam es ist, diese Organe, besonders bei der Aufstellung von neuen Gattungen, in Berücksichtigung zu ziehen.

LITERATURVERZEICHNISS

CZWALINA, G. Die Forcipes der Staphyliniden-Gattung Lathrobium. Deutsche Ent. Zeitschr. (1888) 337.

VERHOEFF, KARL W. Zur vergleichenden Morphologie des Abdomens der Coleopteren und über die phylogenetische Bedeutung desselben. Zeitschr. f. Wissensch. Zool. (1917) 130.

SHARP, DAVID. Studies in Rhynchophora, IV. A preliminary note on the male genitalia. Trans. Ent. Soc. London (1918) 209.

MUIR, FREDERICK. Notes on the ontogeny and morphology of the male genital tube in Coleoptera. Trans. Ent. Soc. London (1918) 223.

ILLUSTRATIONEN

[Zeichnungen von W. Schultze.]

TAFEL 1

FIG. 1. *Eugithopus uhlemanni* sp. nov., natürliche Grösse.
2. *Eugithopus uhlemanni* sp. nov., Seitenansicht des Kopfes, vergrössert.
3. *Acronia ? alboplagiata* sp. nov., natürliche Grösse.
4. *Metapocyrtus (Metapocyrtus) sumptuosus* sp. nov. ♂, × 2.
5. *Euclea gloriosa* sp. nov., ♀ natürliche Grösse.
6. *Doliops multifasciata* sp. nov., × 2.
7. *Pseudapocyrtus apicatus* sp. nov., ♀, × 2.
8. *Aphrodisium palawanum* sp. nov., ♀ natürliche Grösse.
9. *Metapocyrtus* (*Metapocyrtus*) *atocanus* sp. nov., ♂ × 2.
10. *Metapocyrtus* (*Artapocyrtus*) *octomaculatus* sp. nov., ♂, × 2.
11. *Neopyrgops panayensis* sp. nov., × 2.
12. *Metapocyrtus (Metapocyrtus) lindabonus* sp. nov., ♂, × 2.
13. *Homalocyrtus maculatus* sp. nov., ♂, × 2.

TAFEL 2

FIG. 1. *Pachyrrhynchus sulphureomaculatus* sp. nov., ♀, × 2.
2. *Pachyrrhynchus pseudoproteus* sp. nov., ♂, × 2.
3. *Pachyrrhynchus halconensis* sp. nov., ♀, × 2.
4. *Metapocyrtus* (*Metapocyrtus*) *interroptostriatus* sp. nov., ♂, × 2.
5. *Pachyrrhynchus consobrinus* sp. nov., ♂, × 2.
6. *Pachyrrhynchus regius* sp. nov., ♀, × 2.
7. *Pseudapocyrtus catanduanensis* sp. nov., ♀, × 2.
8. *Pachyrrhynchus orbifer* Waterhouse subsp. *azureus* subsp. nov., ♂, × 2.
9. *Pachyrrhynchus semiignitus* sp. nov., ♂, × 2.
10. *Alcides* (*Metallalcides*) *butuanensis* sp. nov., × 2.

TAFEL 3

FIG. 1. *Pachyrrhynchus apicatus* sp. nov.
2. *Pachyrrhynchus venustus* Waterhouse.
3. *Pachyrrhynchus pinorum* Pascoe.
4. *Pachyrrhynchus dubiosus* Schultze.
5. *Pachyrrhynchus tristis* Heller.
6. *Pachyrrhynchus ochroplagiatus* Heller.
7. *Pachyrrhynchus virgatus* Schultze.
8. *Pachyrrhynchus congestus* Pascoe.
9. *Pachyrrhynchus coerulans* Kraatz.
10. *Pachyrrhynchus immarginatus* Kraatz (= *sanchezi* Heller).
11. *Pachyrrhynchus sumptuosus* Schultze.

189549——6

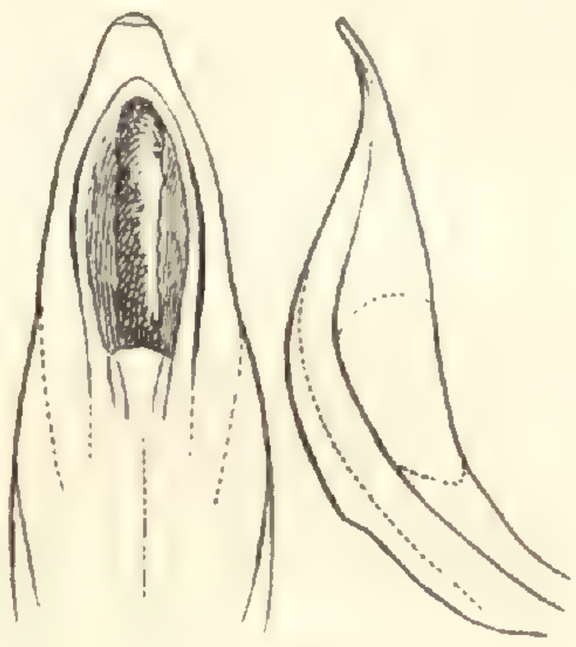
12. *Pachyrrhynchus decussatus* Waterhouse.
13. *Pachyrrhynchus phaleratus* Waterhouse.
14. *Pachyrrhynchus halconensis* sp. nov.
15. *Pachyrrhynchus argus* Pascoe.
16. *Pachyrrhynchus monilifer* Germar.
17. *Pachyrrhynchus orbifer* Waterhouse.
18. *Pachyrrhynchus rugicollis* Waterhouse.
19. *Pachyrrhynchus circulatus* Heller.
20. *Pachyrrhynchus reticulatus* Waterhouse.

TAFEL 4

FIG. 1. *Pachyrrhynchus igorota* Schultze.
2. *Pachyrrhynchus gloriosus* Faust.
3. *Pachyrrhynchus inclytus* Pascoe (= *modestior* Behrens).
4. *Pachyrrhynchus pulchellus* Behrens.
5. *Pachyrrhynchus erosus* Schultze.
6. *Pachyrrhynchus anellifer* Heller.
7. *Pachyrrhynchus erichsoni* Waterhouse.
8. *Metapocyrtus* (*Orthocyrtus*) *insularis* Schultze.
9. *Metapocyrtus* (*Orthocyrtus*) *pachyrrhynchoides* Heller.
10. *Metapocyrtus* (*Artapocyrtus*) *sexmaculatus* Schultze.
11. *Pantorhytes plutus* Oberthür.
12. *Pseudapocyrtus catanduanensis* sp. nov.
13. *Pseudapocyrtus formicarius* Heller.
14. *Apocyrtus inflatus* Erichson.
15. *Homalocyrtus conicus* Boheman.
16. *Homalocyrtus intermittens* Heller.
17. *Homalocyrtus maculatus* sp. nov.
18. *Macrocyrtus erosus* Pascoe.
19. *Macrocyrtus subcostatus* Heller.

TAFEL 1.

TAFEL 2.

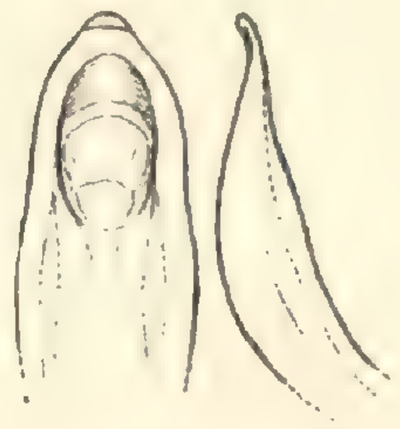


P. apicatus

1

P. venustus

2



P. pinorum

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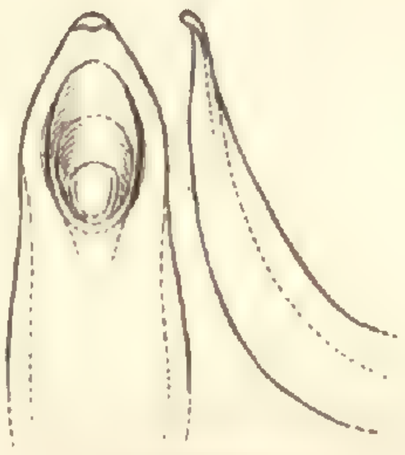
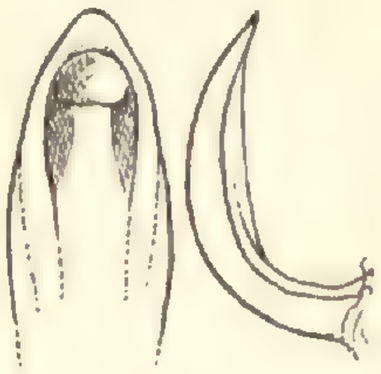


P. dubiosus

4

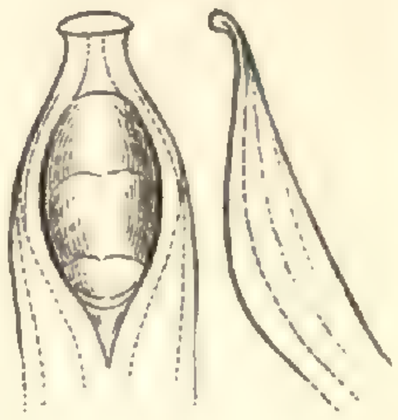
P. tristis

5



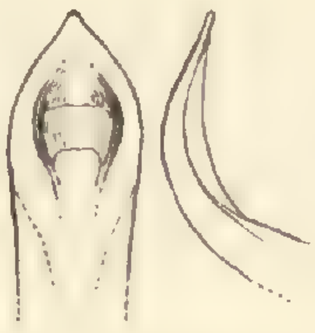
P. ochroplagiatus

6



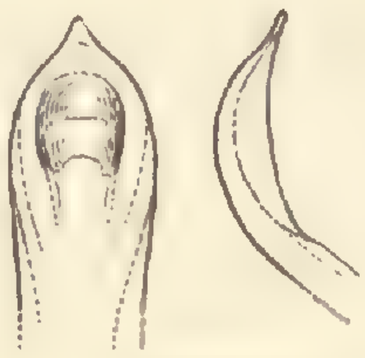
P. virgatus

7



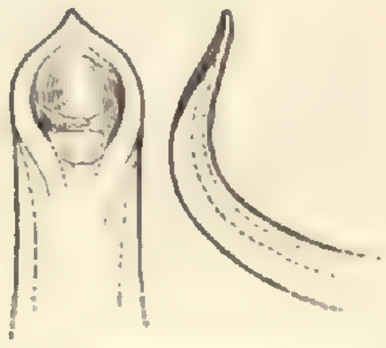
P. congestus

8



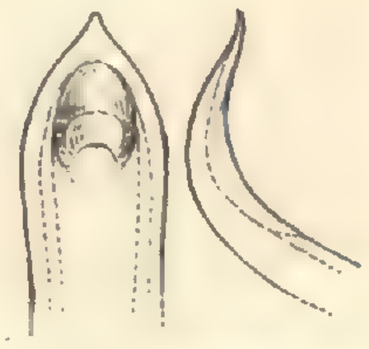
P. coerulans

9



P. immarginatus

10

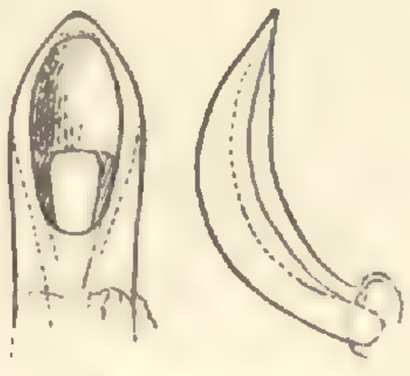


P. sumptuosus

11

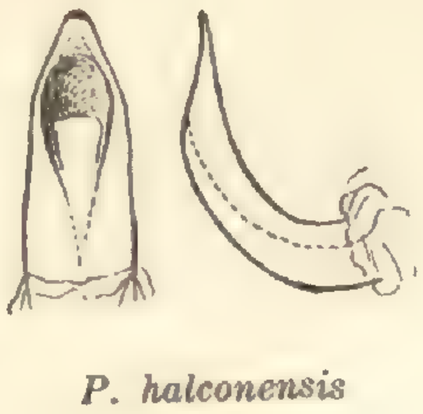
P. decussatus

12



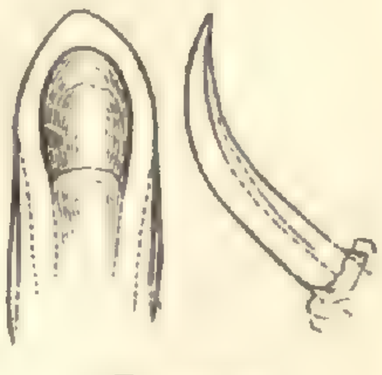
P. phaleratus

13



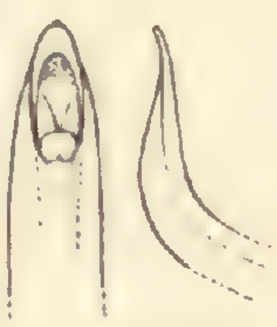
P. halconensis

14



P. argus

15



P. monilifer

16

P. orbifer

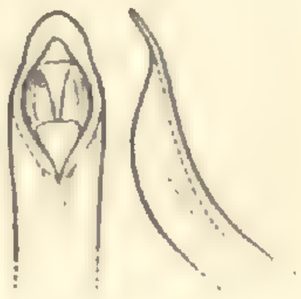
17

P. rugicollis

18

P. circulatus

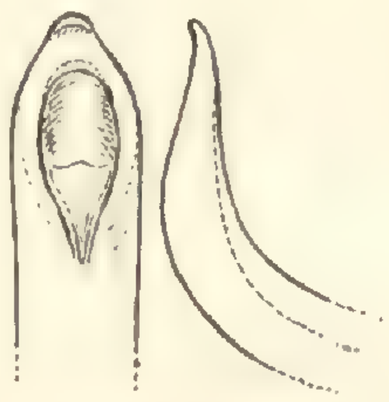
19



P. reticulatus

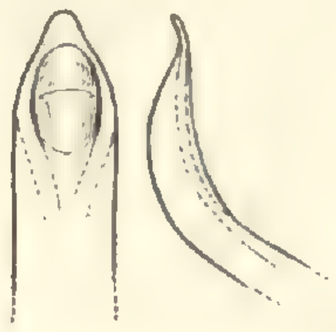
20

TAFEL 3. PENISFORMEN VON VERSCHIEDENEN PACHYRRHYNCHUS-ARTEN.



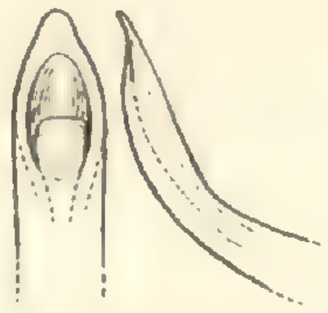
Pachyrrhynchus igorota

1



Pachyrrhynchus gloriosus

2

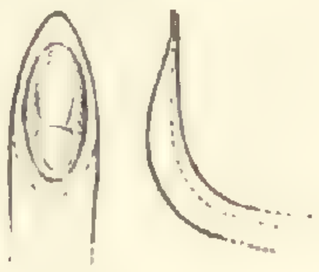


Pachyrrhynchus inclytus

3

Pachyrrhynchus pulchellus

4

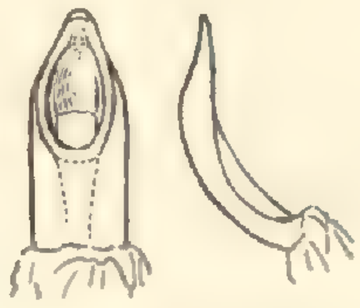


Pachyrrhynchus erosus

5

Pachyrrhynchus anellifer

6



Pachyrrhynchus erichsoni

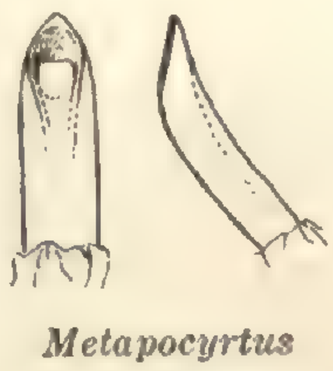
7

Metapocyrtus (Orthocyrtus) insularis

8

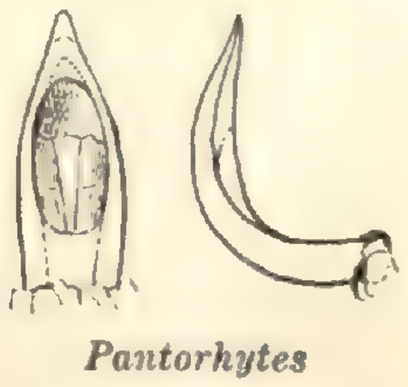
Metapocyrtus (Orthocyrtus) pachyrrhynchoides

9



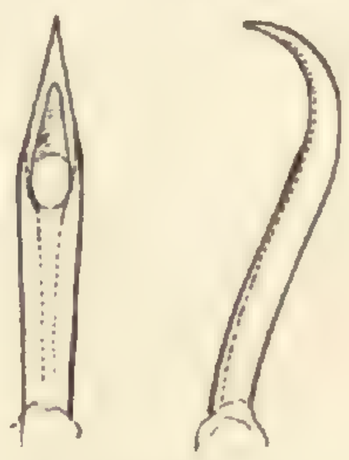
Metapocyrtus (Artapocyrtus) sexmaculatus

10



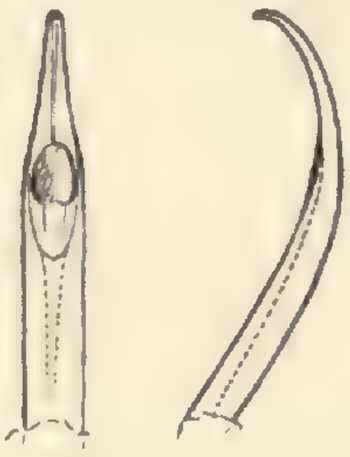
Pantorhytes plutus

11



Pseudapocyrtus catanduanensis

12

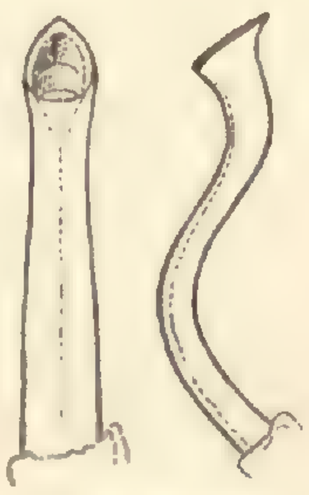


Pseudapocyrtus formicarius

13

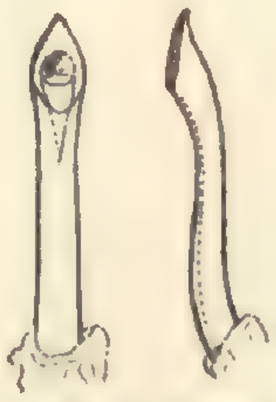
Apocyrtus inflatus

14



Homalocyrtus conicus

15

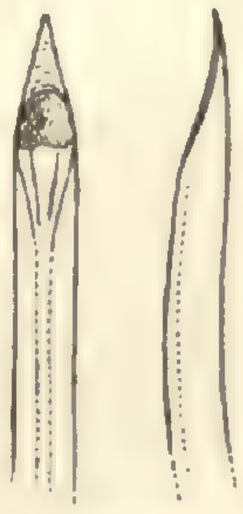


Homalocyrtus intermittens

16

Homalocyrtus maculatus

17



Macrocyrtus erosus

18

Macrocyrtus subcostatus

19

TAFEL 4. PENISFORMEN VON PACHYRRHYNCHINEN.

ERRATA

Volume 20, page 276, the generic name in the side heads should read Poeciloterpa. Cancel the second correction on page 671.

Volume 21, page 162, *for* line 8 *read* April 23 to May 1. Balbalan. Rains began four days after my arrival,

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[New generic and specific names and new combinations are printed in **clarendon**; synonyms and names of species incidentally mentioned in the text are printed in *italic*.]

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